# Project: Building Checks With Pupils
## Subject: Technical Report from Engineering Check
## Date: September 2019

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*Athens*
*September 2019*

INTRODUCTION - SCOPE OF PROJECT – METHODOLOGY

In the present report illustrated the main findings, notes and proposals from Engineers that participate in project: “Building checks with pupils” as a part of the biggest project of climate schools Be.AT (Berlin – Athens)

During this project several technical visits from Engineers performed in ten (10) Public school of municipal of Athens. The scope of visits was the Energy Inspection of Buildings in order to focus in main issues that occurs high energy consumption during a typical school year and also to propose technical measures to upgrade the energy efficient of buildings. Along technical visits Engineers recording also the notes and proposals from pupils and Teachers in special meeting that was called "Energy Tour With Pupils".

The Energy inspection including not only site inspection of building quality and conditions, but also data collection and evaluation from energy consumption (electricity, gas, oil). Based on these for each school a variety of measures proposed with main goal:

- Improving thermal comfort in Educational - School Buildings.
- Reduce of energy consumption, CO2 emissions and operation cost.
- Reduce the wasting of energy that occurred from not proper technical installations.
- Upgrade the operation of heating system.
- Familiarize students with energy-saving practices.

The main methodology that it is applied in this project describe in following paragraphs.

Based on technical visits in schools and meetings with Technical Department of Municipal of Athens, the Engineers Team procced in:

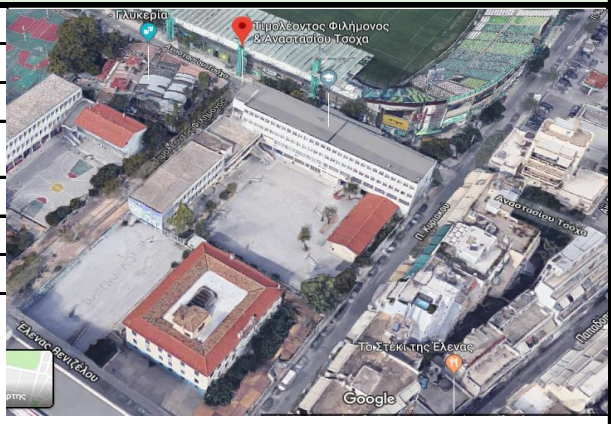
- Collection of any available data for each building school. The available data were clarified in three main categories
    - A – Existing drawings from building license (architectural, EM, etc)
    - B – Performance on heating system based on yearly check that performed from Techical Department
    - C- Energy Consumption data from bills (electricity, gas, oil)
- Creation Drawings for heating system as an output of technical visit and energy inspection.
- Internal meetings of engineers team in order to summarize the findings of Energy Inspection and make the proposals of small intervention for changing the operation habits and in some cases reduce energy consumptions.
- **Data Base design for buildings.** All the above mention data, notes and proposal stored in a common data base that can be used as a tools for making decision and organize next step in order to achieve the goal of the project. This data base, that present in following paragraphs and is submitted in electronic form, could be used as a general tools not only for the schools that participate in the project but for all the schools of Municipal of Athens.

The schools that participate in the project presented in following table.

| LIST OF SCHOOLS | | | | |
|---|---|---|---|---|
| ID | NUMBER | TYPE | Andress | CODE (ID_NUMBER OF SCHOOL_TYPE OF SCHOOL_ ANDRESS) |
| 1 | 2 | Experimental Gymnasium | Filimonos & Tsoxa St, 11521, Athens | 01_2_EXPERIMENTAL_GYMNASIUM_ FILIMONOS & TSOXA |
| 2 | 152 | Primary School | Miliaraki & Kourtidou St, 11145, Athens | 02_152_PRIMARY_SCHOOL_MILIARAKI 59 & KOURTIDOU |
| 3 | 1 | Experimental Gymnasium | 114, Adrianou St, 10557, Athens | 03_1_EXPERIMENTAL_GYMNASIUM_ANDRIANOU 114 |
| 4 | 21 | Primary School | 43, Kyprou St, 11253, Athens | 04_21_PRIMARY_SCHOOL_KYPROU 43 |
| 5 | 39 | Primary School | Axarnwn & Tsounta St, 11143, Athens | 05_39_EXPERIMANTAL_SCHOOL_AXARNWN & TSOUNTA |
| 6 | 43 | Gymnasium and Lyceum | 2, Asprogeraka St, 11744, Athens | 06_43_GYMNASIUM_LYCEUM_ ASPROGERAKA 2 |
| 7 | 40 | Primary School | Momferatou & Falireos St, 11475, Athens | 07_40_PRIMARY_SCHOOL_MOMFERATOY & FALHREOS & RAGAVI |
| 8 | 22 | Primary School | 50, Leukosias St, 11253, Athens | 08_22_PRIMARY_SCHOOL_LEUKOSIAS 50 |
| 9 | 14 | Lyceum | Sikelias & Aglayroy St, 11741, Athens | 09_14_LYCEUM_SIKELIAS & AGLAYROY |
| 10 | 93 | Primary School | 9, Pytheoy St, 11743, Athens | 10_2_PRIMARY_SCHOOL_PYTHEOY 9 |

## GENERAL INFORMATION

| | |
|---|---|
| School Name | 2 Experimental Gymnasium |
| School Type | Experimental Gymnasium |
| Andrees | Filimonos & Tsoxa St, 11521, Athens |
| Director | Makridis Panagiotis/Vicky Gitzia |
| Tel | 21 0646 5673 |
| website | http://2gym-peir-athin.att.sch.gr/ |
| email | mail@2gym-peir-athin.att.sch.gr |
| Pupils/ Students | 486 |
| Teachers | 48 |
| Total Users | 534 |




## BUILING DATA

| | |
|---|---|
| YEAR OF CONTRUCNTION | 1980 |
| RENOVATION YEAR. | NA |
| BUILDING PARTS | 3 |
| BUILDING FLOORS | 3 |
| TOTAL S.M. | 4650 |
| m²/ STUDEN | 9.57 |
| m²/ USER | 8.71 |

| LEVEL | AREA (m²) | CLASS ROOM |
|---|---|---|
| -1 FLOOR | 150 | |
| 0 FLOOR | 1450 | |
| 1th FLOOR | 1240 | |
| 2th FLOOR | 1240 | |
| 3th FLOOR | 570 | |
| 4th FLOOR | 0 | |
| SUM | 4650 | 18 |

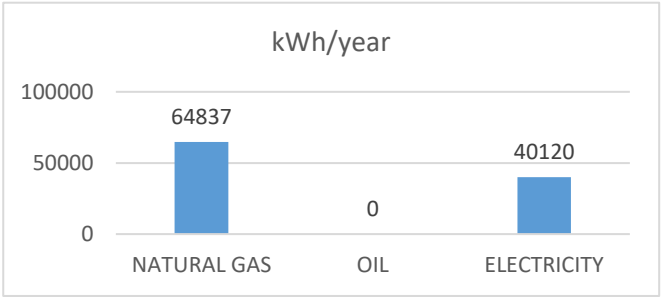
## BUILDING CONSTUCTION QUALITY

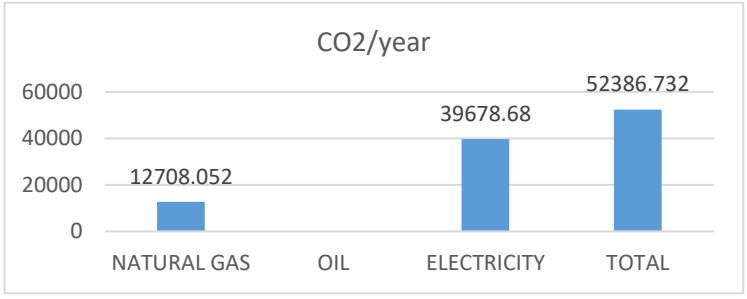
| | DESCRIPTION |
|---|---|
| FOOTINGS | Uninsullated Concrete |
| WALLS | Single Brick |
| BEAMS | Uninsulated Concrete |
| ROOF | Waterproof Insulation - Bad Quallity |
| WINDOWS | Single Glass with Alluminium frame |
| DOORS | Iron made doors, with 10% of single glass |
| SHADING | internal shading - courtains |
| Notes | |

## ENERGY CONSUMPTION DATA - SPECIFIC VALUES

| CONSUMPTIONS | 2016 | 2017 | 2018 | 2019 | AVERAGE | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 64837 | NA | NA | NA | 64837 | kWh(th)/year |
| OIL | 0 | 0 | 0 | 0 | 0 | lt/year |
| ELECTRICITY | NA | 39800 | 40440 | NA | 40120 | kWh(el)/year |

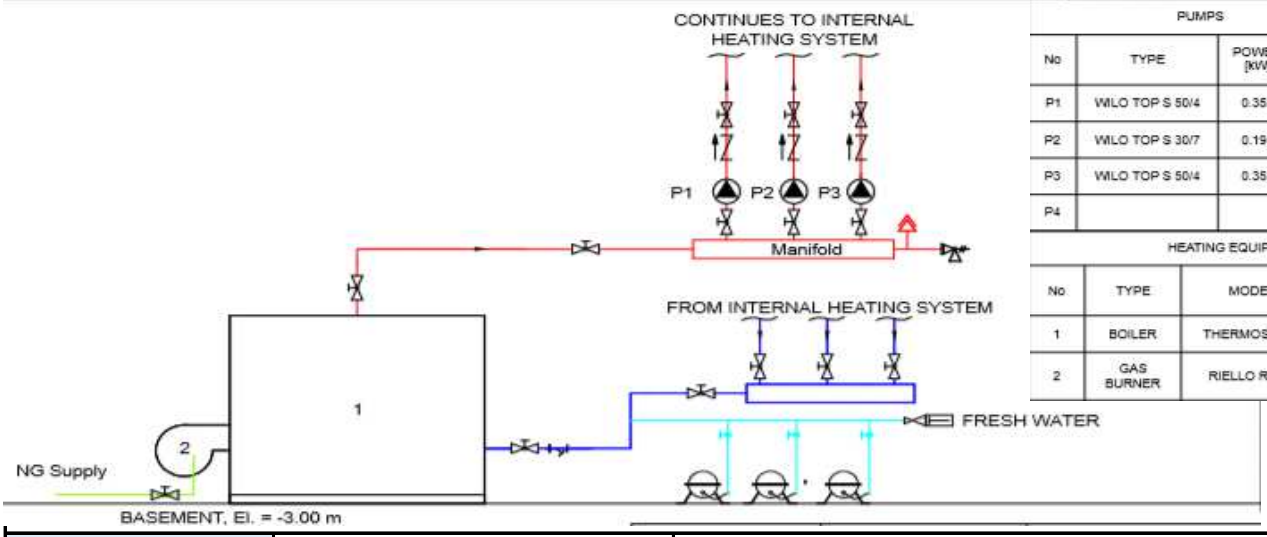
| SPECIFIC ENERGY | Per Building Area | | Per User | | CO2 EMISSIONS | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 13.94 | kWh(th)/y.s.m | 121.418 | kWh(th)/y.user | 12708.052 | kg CO2/Year |
| OIL | 0.00 | lt/year.s.m | 0.000 | lt/y.user | | kg CO2/Year |
| ELECTRICITY | 8.63 | kWh(el)/y.s.m | 75.131 | kWh(el)/y.user | 39678.68 | kg CO2/Year |
| | | | | TOTAL | 52386.732 | kg CO2/Year |



## HEATING SYSTEM DESCRIPTION

### DRAFT HEATING SYSTEM DRAWING




| PUMPS | | | | |
|---|---|---|---|---|
| No | TYPE | POWER [kW] | FLOW [m3/h] | HEAD [m] |
| P1 | WILO TOP S 50/4 | 0.355 | 11 | 4 |
| P2 | WILO TOP S 30/7 | 0.195 | 5 | 4 |
| P3 | WILO TOP S 50/4 | 0.355 | 11 | 4 |
| P4 | | | | |

| HEATING EQUIPMENT | | | |
|---|---|---|---|
| No | TYPE | MODEL | HEATING POWER [kW] |
| 1 | BOILER | THERMOSTAHL | 523 |
| 2 | GAS BURNER | RIELLO RS-50 | 115-600 |

| | | |
|---|---|---|
| FUEL TYPE | GASS | PRODUCT DESCRIPTION |
| BOILER 1 | 523 kW | THERMOSTAHL |
| BOILER 2 | kW | |
| BOILER 3 | kW | |
| BURNER 1 | 115-600 kW | RIELLO RS-50 |
| BURNER 2 | kW | |
| BURNER 3 | kW | |
| | TOTAL | 523 kW(thl) |

| CIRCULATORS | TYPE | Head [m] | flow [m³/h] | EL.DATA [kW] |
|---|---|---|---|---|
| PUMP 1 | WILLO TOP S - 50/4 | 4 | 11 | 0.33 |
| PUMP 2 | WILLO TOP S - 30/7 | 4 | 5 | 0.195 |
| PUMP 3 | WILLO TOP S - 50/4 | 4 | 11 | 0.33 |
| PUMP 4 | | | | |
| PUMP 5 | | | | |
| PUMP 6 | | | | |
| | | TOTAL | | 0.855 kW(el) |

| MEASUREMENTS (AVARAGE VALUE FROM AVAILABLE DATA) | | | | | | |
|---|---|---|---|---|---|---|
| | HEATING SYSTEM 1 | | HEATING SYSTEM 2 | | HEATING SYSTEM 3 | |
| EXHAUST GAS TEMP. | 202.6 | °C | 0 | °C | | °C |
| CARBON MONOXIDE | 26 | ppm | 0 | ppm | | ppm |
| OXIDE OF NITROGEN | 67 | ppm | 0 | ppm | | ppm |
| OXIGEN | 5.2 | % | 0 | % | | % |
| CARBON DIOXIDE | 8.9 | % | 0 | % | | % |
| GAS PRESSURE | 32.2 | mbar | 0 | mbar | | mbar |
| OPARATION GAS PRES | 21.3 | mbar | 0 | mbar | | mbar |
| WATER TEMP. | 67 | °C | 0 | °C | | °C |
| CALCULATIONS | | | | | | |
| EFFICIENT | 91.9 | % | 0 | % | | % |
| GAS LOSSES | 8.1 | % | 0 | % | | % |
| GAS SUPPLY | 47.1 | m3/h | 0 | m3/h | | m3/h |
| **HEATING CAPACITY / S.M.** | **112.47** | **WATTS/s.m** | | | | |

**COOLING SYSTEM**

| ROOM | TYPE |
|---|---|
| OFFICES | SPLIT UNIT |
| CLASS | NA |
| GYM | NA |
| BOOKSTORE | SPLIT UNIT |
| MULTIPURPOSE HALL | SPLIT UNIT |

**FRESH AIR SYSTEM - VENTILATORS**

| ROOM | TYPE | |
|---|---|---|
| OFFICES | FRESH AIR FROM WINDOWS | FLUSH MOUNT SEILING FANS |
| CLASS | FRESH AIR FROM WINDOWS | |
| GYM | FRESH AIR FROM WINDOWS | |
| BOOKSTORE | FRESH AIR FROM WINDOWS | FLUSH MOUNT SEILING FANS |
| MULTIUSE ROOM | FRESH AIR FROM WINDOWS | FLUSH MOUNT SEILING FANS |

**LIGHITING**

| ROOM | TYPE |
|---|---|
| OFFICES | TYPICAL FLUORESCENT LIGHTING |
| CLASS | TYPICAL FLUORESCENT LIGHTING |
| GYM | TYPICAL FLUORESCENT LIGHTING |
| BOOKSTORE | TYPICAL FLUORESCENT LIGHTING |
| MULTIUSE ROOM | TYPICAL FLUORESCENT LIGHTING |

DESCRITPTION OF EQUIPMENT AND OPERATION

HEATING SYSTEM DESCRIPTION

**1 - HEATING PIPE**

Heating pipes are made from black iron in several diameters. The internal part of pipe network are uninsulated. The external part, has typical armaflex insulation 13mm, without UV protection. This part are damaged and need to be repair.

**2 - PUMPS**

Pumps are constant speed driven and the opperation is controlled by water temperature in supply line of boiler. In case of damage need to be changed from inverter driven pumps based on EUP 2015 directive.

**3 - CHIMNEY**

Chimney of boiler is uninsulated and does not cover the national regulation for construction material and external insulation.

**4 - BOILER - BURNER**

Boiler operation temperature is constant all over the heating period. Main Operation temperatures are 65-70 °C.

The control strategy of heating system is: Manual On - Off based on daily schedule. Typical operation hours from 7.30 pm to 12.00 pm. The is no thermostat in any typical room of school.

**5- CLASS OPERATION CONDITIONS**

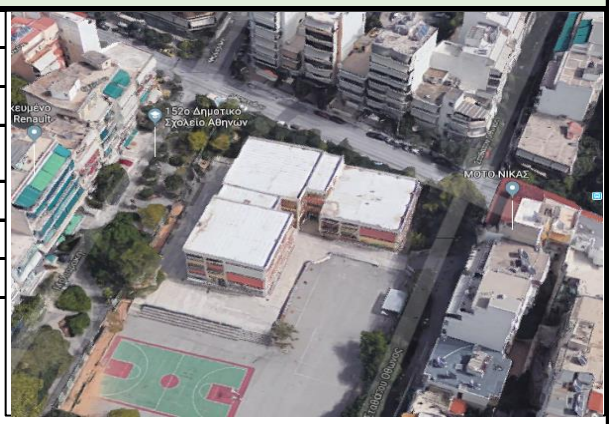
The main air temperature in class was measured from 18-20 °C during winter. Good thermal confort contitions

**PROPOSALS FOR UPGRATE**

1) New insulated chimney according to national standards should be installed
2) Maintenance and repair of waterproof roofing system (water insulation)
3) Thermal Insulation of pipes and fittings inside the mechanical room
4) Thermal Insulation with UV protection of external pipe network
5) New switch board with timer for heating system should be installed for more efficient operation

## GENERAL INFORMATION

| | |
|---|---|
| School Name | 152 Primary School |
| School Type | Primary School |
| Andrees | Miliaraki & Kourtidou St, 11145, Athens |
| Director | Besios Antonios |
| Tel | 2108314280 |
| website | https://blogs.sch.gr/152dimat/ |
| email | mail@152dim-athin.att.sch.gr |
| Pupils/ Students | 200 |
| Teachers | 19 |
| Total Users | 219 |




## BUILING DATA

| | |
|---|---|
| YEAR OF CONTRUCNTION | 1980 |
| RENOVATION YEAR. | |
| BUILDING PARTS | 3 |
| BUILDING FLOORS | 3 |
| TOTAL S.M. | 2483.01 |
| m²/ STUDEN | 12.42 |
| m²/ USER | 11.34 |

| LEVEL | AREA (m²) | CLASS ROOM |
|---|---|---|
| -1 FLOOR | - | |
| 0 FLOOR | 909.64 | |
| 1th FLOOR | 924.91 | |
| 2th FLOOR | 648.46 | |
| 3th FLOOR | - | |
| 4th FLOOR | - | |
| SUM | 2483.01 | 9.00 |

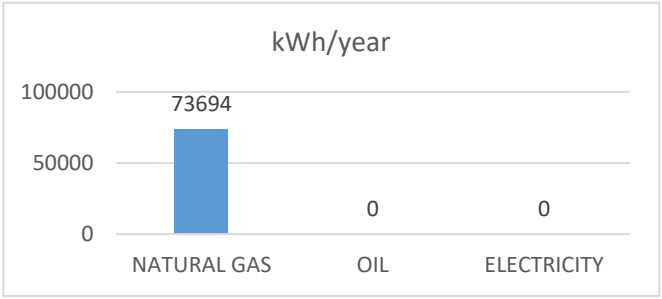
## BUILDING CONSTUCTION QUALITY

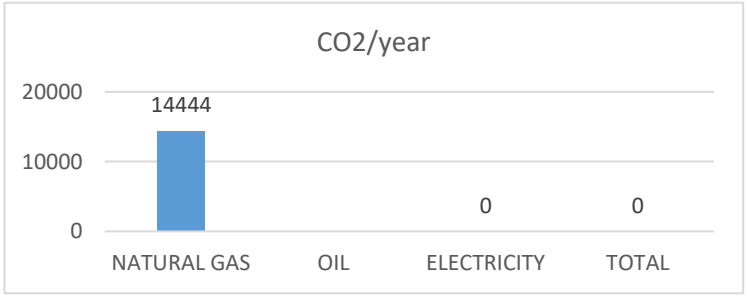
| | DESCRIPTION |
|---|---|
| FOOTINGS | Uninsulated Concrete |
| WALLS | Single Brick |
| BEAMS | Uninsulated Concrete |
| ROOF | Waterproof Insulation - Good quallity |
| WINDOWS | Single Glass with Alluminium frame |
| DOORS | Iron made doors, with 10% of single glass |
| SHADING | internal shading - courtains |
| Notes | |

## ENERGY CONSUMPTION DATA - SPECIFIC VALUES

| CONSUMPTIONS | 2016 | 2017 | 2018 | 2019 | AVERAGE | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 73694 | NA | NA | NA | 73694 | kWh(th)/year |
| OIL | 0 | 0 | 0 | 0 | 0 | lt/year |
| ELECTRICITY | NA | NA | NA | NA | #ΣΥΝΔΕΣΗ! | kWh(el)/year |

| SPECIFIC ENERGY | Per Building Area | | Per User | | CO2 EMISSIONS | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 29.68 | kWh(th)/y.s.m | 336.502 | kWh(th)/y.user | 14444 | kg CO2/Year |
| OIL | 0.00 | lt/year.s.m | 0.000 | lt/y.user | | kg CO2/Year |
| ELECTRICITY | #ΣΥΝΔΕΣΗ! | kWh(el)/y.s.m | #ΣΥΝΔΕΣΗ! | kWh(el)/y.user | #ΣΥΝΔΕΣΗ! | kg CO2/Year |
| | | | | TOTAL | #ΣΥΝΔΕΣΗ! | kg CO2/Year |



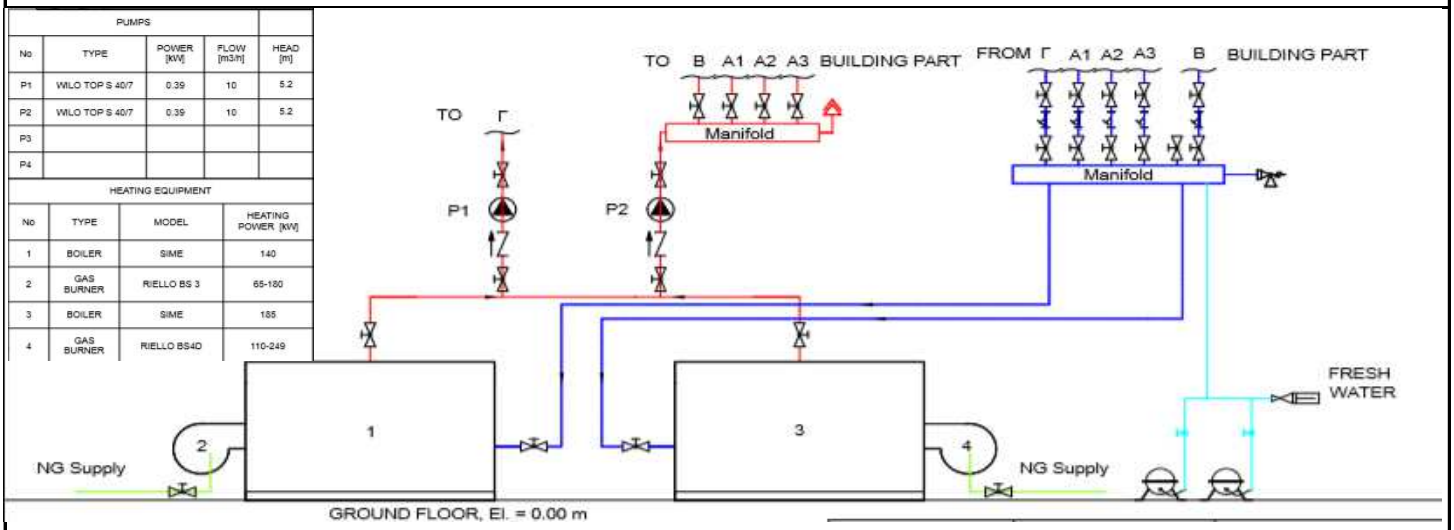



## HEATING SYSTEM DESCRIPTION

### DRAFT HEATING SYSTEM DRAWING

| PUMPS | | | | |
|---|---|---|---|---|
| No | TYPE | POWER [kW] | FLOW [m3/h] | HEAD [m] |
| P1 | WILO TOP S 40/7 | 0.39 | 10 | 5.2 |
| P2 | WILO TOP S 40/7 | 0.39 | 10 | 5.2 |
| P3 | | | | |
| P4 | | | | |

| HEATING EQUIPMENT | | | |
|---|---|---|---|
| No | TYPE | MODEL | HEATING POWER [kW] |
| 1 | BOILER | SIME | 140 |
| 2 | GAS BURNER | RIELLO BS 3 | 65-180 |
| 3 | BOILER | SIME | 185 |
| 4 | GAS BURNER | RIELLO BS4D | 110-249 |




| | | | |
|---|---|---|---|
| FUEL TYPE | GASS | PRODUCT DESCRIPTION | |
| BOILER 1 | 140 kW | SIME | |
| BOILER 2 | 185 kW | SIME | |
| BOILER 3 | kW | | |
| BURNER 1 | 65-189 kW | RIELO BS3 | |
| BURNER 2 | 110-249 kW | RIELLO BS4D | |
| BURNER 3 | kW | | |
| | | TOTAL | 325 kW(thl) |

| CIRCULATORS | TYPE | Head [m] | flow [m³/h] | EL.DATA [kW] |
|---|---|---|---|---|
| PUMP 1 | WILLO TOP S - 40/7 | 5.2 | 10 | 0.39 |
| PUMP 2 | WILLO TOP S - 40/7 | 5.2 | 10 | 0.39 |
| PUMP 3 | | | | |
| PUMP 4 | | | | |
| PUMP 5 | | | | |
| PUMP 6 | | | | |
| | | | TOTAL | 0.78 kW(el) |

| MEASUREMENTS (AVARAGE VALUE FROM AVAILABLE DATA) | | | | | | |
|---|---|---|---|---|---|---|
| | HEATING SYSTEM 1 | | HEATING SYSTEM 2 | | HEATING SYSTEM 3 | |
| EXHAUST GAS TEMP. | 170 | °C | 198 | °C | | °C |
| CARBON MONOXIDE | 0 | ppm | 0 | ppm | | ppm |
| OXIDE OF NITROGEN | 20 | ppm | 21 | ppm | | ppm |
| OXIGEN | 5.4 | % | 5.1 | % | | % |
| CARBON DIOXIDE | 8.7 | % | 8.8 | % | | % |
| GAS PRESSURE | 28.5 | mbar | 28.5 | mbar | | mbar |
| OPARATION GAS PRES | 22.3 | mbar | 23.1 | mbar | | mbar |
| WATER TEMP. | 57 | °C | 65 | °C | | °C |
| CALCULATIONS | | | | | | |
| EFFICIENT | 92.4 | % | 91.1 | % | | % |
| GAS LOSSES | 7.6 | % | 8.9 | % | | % |
| GAS SUPPLY | 13 | m3/h | 17.8 | m3/h | | m3/h |

| | | |
|---|---|---|
| **HEATING CAPACITY / S.M.** | **130.89** | **WATTS/s.m** |

**COOLING SYSTEM**

| ROOM | TYPE |
|---|---|
| OFFICES | SPLIT UNIT |
| CLASS | NA |
| GYM | NA |
| BOOKSTORE | SPLIT UNIT |
| MULTIPURPOSE HALL | SPLIT UNIT |

**FRESH AIR SYSTEM - VENTILATORS**

| ROOM | TYPE |
|---|---|
| OFFICES | FRESH AIR FROM WINDOWS |
| CLASS | FRESH AIR FROM WINDOWS |
| GYM | FRESH AIR FROM WINDOWS |
| BOOKSTORE | FRESH AIR FROM WINDOWS |
| MULTIUSE ROOM | FRESH AIR FROM WINDOWS |

**LIGHITING**

| ROOM | TYPE |
|---|---|
| OFFICES | TYPICAL FLUORESCENT LIGHTING |
| CLASS | TYPICAL FLUORESCENT LIGHTING |
| GYM | TYPICAL FLUORESCENT LIGHTING |
| BOOKSTORE | TYPICAL FLUORESCENT LIGHTING |
| MULTIUSE ROOM | TYPICAL FLUORESCENT LIGHTING |

DESCRITPTION OF EQUIPMENT AND OPERATION

HEATING SYSTEM DESCRIPTION

**1 - HEATING PIPE**

Heating pipes are made from black iron in several diameters. The internal part of pipe network are uninsulated. In some cases the radiators are connected vise versa.

**2 - PUMPS**

Pumps are constant speed driven and the opperation is controlled by water temperature in supply line of boiler. In case of damage need to be changed from inverter driven pumps based on EUP 2015 directive.

**3 - CHIMNEY**

Chimney of boiler is uninsulated and does not cover the national regulation for construction material and external insulation.

**4 - BOILER - BURNER**

Boiler operation temperature is constant all over the heating period. Main Operation temperatures are 65-70 °C.

The control strategy of heating system is: Manual On - Off based on daily schedule. Typical operation hours from 7.30 pm to 12.00 pm. The is no thermostat in any typical room of school.

**5- CLASS OPERATION CONDITIONS**

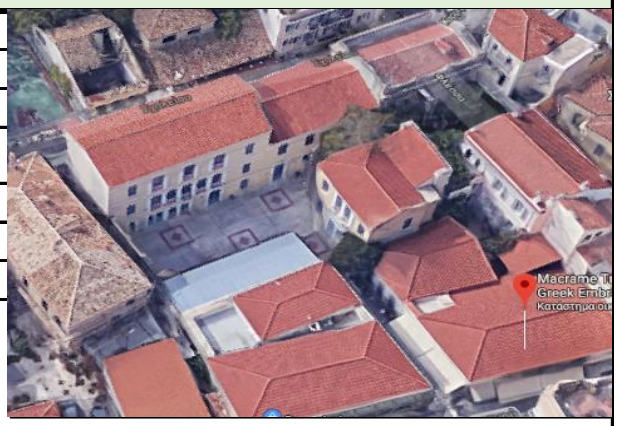
The main air temperature in class was measured from 18-20 °C during winter. Good thermal confort contitions

**PROPOSALS FOR UPGRATE**

1) Thermal Insulation of pipes and fittings inside the mechanical room
2) New switch board with timer for heating system should be installed for more efficient operation
3) Installation of temperature control unit for heating system based on external conditions in order to avoid overheating of building during hot winder day
4) Installation of Air Condition Unit, new led lightings and curtains to stairs in main entrance of school
5) Installation of Air Condition Unit and external shading system in classroom for children with special education needs
6) Installation data logger for monitoring energy use for heating and electricity

## GENERAL INFORMATION

| | |
|---|---|
| School Name | 1 Experimental Gymnasium |
| School Type | Experimental Gymnasium |
| Andrees | 114, Adrianou St, 10557, Athens |
| Director | Kontogiannis Kostis |
| Tel | 2108314280 |
| website | http://www.1gympeirath.gr/sxoleio/ |
| email | 1gympeir@sch.gr |
| Pupils/ Students | 243 |
| Teachers | 26 |
| Total Users | 269 |



## BUILING DATA

| | |
|---|---|
| YEAR OF CONTRUCNTION | 1936 |
| RENOVATION YEAR. | 2005 |
| BUILDING PARTS | 3 |
| BUILDING FLOORS | 3 |
| TOTAL S.M. | 1442.16 |
| m²/ STUDEN | 5.93 |
| m²/ USER | 5.36 |

| LEVEL | AREA (m²) | CLASS ROOM |
|---|---|---|
| -1 FLOOR | 480.72 | |
| 0 FLOOR | 480.72 | |
| 1th FLOOR | 480.72 | |
| 2th FLOOR | - | |
| 3th FLOOR | - | |
| 4th FLOOR | - | |
| SUM | 1442.16 | 0.00 |

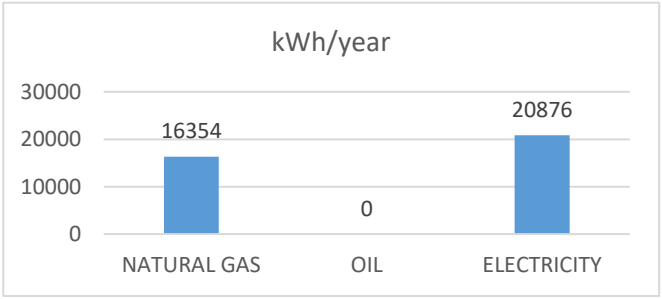
## BUILDING CONSTUCTION QUALITY

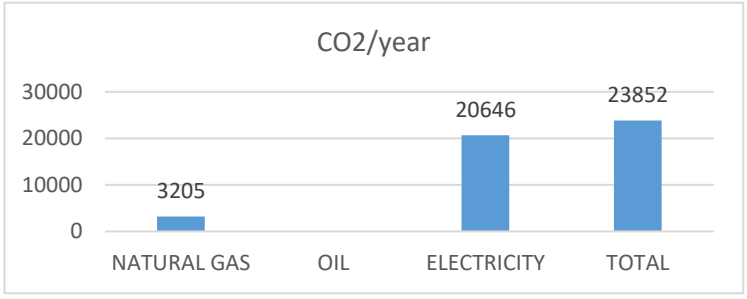
| | DESCRIPTION |
|---|---|
| FOOTINGS | Uninsulated Concrete |
| WALLS | Stone |
| BEAMS | |
| ROOF | Roof with tile |
| WINDOWS | Single Glass Wooden Frame |
| DOORS | Iron made doors, with 20% of single glass |
| SHADING | internal shading - courtains |
| Notes | |

## ENERGY CONSUMPTION DATA - SPECIFIC VALUES

| CONSUMPTIONS | 2016 | 2017 | 2018 | 2019 | AVERAGE | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 16354 | NA | NA | NA | 16354 | kWh(th)/year |
| OIL | 0 | 0 | 0 | 0 | 0 | lt/year |
| ELECTRICITY | NA | 22346 | 19406 | NA | 20876 | kWh(el)/year |

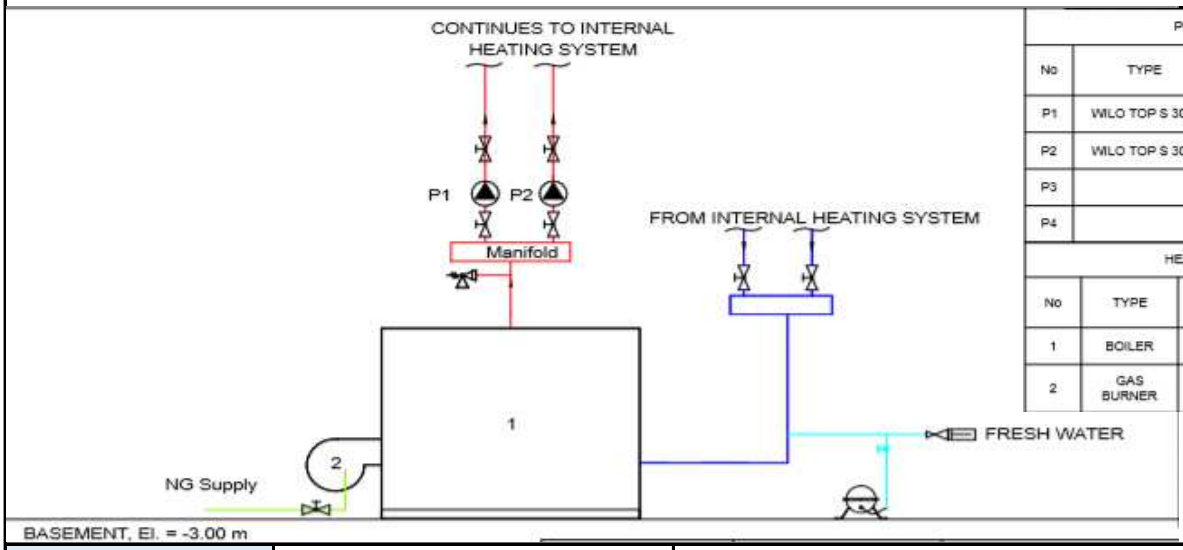
| SPECIFIC ENERGY | Per Building Area | | Per User | | CO2 EMISSIONS | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 11.34 | kWh(th)/y.s.m | 60.796 | kWh(th)/y.user | 3205 | kg CO2/Year |
| OIL | 0.00 | lt/year.s.m | 0.000 | lt/y.user | | kg CO2/Year |
| ELECTRICITY | 14.48 | kWh(el)/y.s.m | 77.606 | kWh(el)/y.user | 20646 | kg CO2/Year |
| | | | | TOTAL | 23852 | kg CO2/Year |



## HEATING SYSTEM DESCRIPTION

### DRAFT HEATING SYSTEM DRAWING




| PUMPS | | | | |
|---|---|---|---|---|
| No | TYPE | POWER [kW] | FLOW [m3/h] | HEAD [m] |
| P1 | WILO TOP S 30/7 | 0.195 | 5 | 4 |
| P2 | WILO TOP S 30/7 | 0.195 | 5 | 4 |
| P3 | | | | |
| P4 | | | | |

| HEATING EQUIPMENT | | | |
|---|---|---|---|
| No | TYPE | MODEL | HEATING POWER [kW] |
| 1 | BOILER | BENTOIL | 150 |
| 2 | GAS BURNER | RIELLO BS 3 | 65-189 |

| | | | |
|---|---|---|---|
| FUEL TYPE | GASS | PRODUCT DESCRIPTION | |
| BOILER 1 | 150 kW | BENTOIL | |
| BOILER 2 | kW | | |
| BOILER 3 | kW | | |
| BURNER 1 | 65-189 kW | RIELLO BS 3 | |
| BURNER 2 | kW | | |
| BURNER 3 | kW | | |
| | | TOTAL | 150 kW(thl) |

| CIRCULATORS | TYPE | Head [m] | flow [m³/h] | EL.DATA [kW] |
|---|---|---|---|---|
| PUMP 1 | | | | |
| PUMP 2 | | | | |
| PUMP 3 | | | | |
| PUMP 4 | | | | |
| PUMP 5 | | | | |
| PUMP 6 | | | | |
| | | | TOTAL | 0 kW(el) |

| MEASUREMENTS (AVARAGE VALUE FROM AVAILABLE DATA) | | | | | | |
|---|---|---|---|---|---|---|
| | HEATING SYSTEM 1 | | HEATING SYSTEM 2 | | HEATING SYSTEM 3 | |
| EXHAUST GAS TEMP. | 239.7 | °C | | °C | | °C |
| CARBON MONOXIDE | 35 | ppm | | ppm | | ppm |
| OXIDE OF NITROGEN | 37 | ppm | | ppm | | ppm |
| OXIGEN | 4.4 | % | | % | | % |
| CARBON DIOXIDE | 9.3 | % | | % | | % |
| GAS PRESSURE | 26.3 | mbar | | mbar | | mbar |
| OPARATION GAS PRES | 18.5 | mbar | | mbar | | mbar |
| WATER TEMP. | 67 | °C | | °C | | °C |
| CALCULATIONS | | | | | | |
| EFFICIENT | 90.9 | % | | % | | % |
| GAS LOSSES | 9.1 | % | | % | | % |
| GAS SUPPLY | 13 | m3/h | | m3/h | | m3/h |

| | | |
|---|---|---|
| **HEATING CAPACITY / S.M.** | **104.01** | **WATTS/s.m** |

| COOLING SYSTEM | |
|---|---|
| ROOM | TYPE |
| OFFICES | SPLIT UNIT |
| CLASS | NA |
| GYM | NA |
| BOOKSTORE | NA |
| MULTIPURPOSE HALL | NA |

| FRESH AIR SYSTEM - VENTILATORS | |
|---|---|
| **ROOM** | **TYPE** |
| OFFICES | FRESH AIR FROM WINDOWS |
| CLASS | FRESH AIR FROM WINDOWS |
| GYM | NA |
| BOOKSTORE | MECHANICAL VENDILATION |
| MULTIUSE ROOM | MECHANICAL VENDILATION |

| LIGHITING | |
|---|---|
| **ROOM** | **TYPE** |
| OFFICES | TYPICAL FLUORESCENT LIGHTING |
| CLASS | TYPICAL FLUORESCENT LIGHTING |
| GYM | TYPICAL FLUORESCENT LIGHTING |
| BOOKSTORE | TYPICAL FLUORESCENT LIGHTING |
| MULTIUSE ROOM | TYPICAL FLUORESCENT LIGHTING |

DESCRITPTION OF EQUIPMENT AND OPERATION

HEATING SYSTEM DESCRIPTION

**1 - HEATING PIPE**

Heating pipes are made from black iron in several diameters. The internal part of pipe network are uninsulated.

**2 - PUMPS**

Pumps are constant speed driven and the opperation is controlled by water temperature in supply line of boiler. In case of damage need to be changed from inverter driven pumps based on EUP 2015 directive.

**3 - CHIMNEY**

Chimney of boiler is uninsulated and does not cover the national regulation for construction material and external insulation.

**4 - BOILER - BURNER**

Boiler operation temperature is constant all over the heating period. Main Operation temperatures are 65-70 °C.

The control strategy of heating system is: Manual On - Off based on daily schedule. Typical operation hours from 7.30 pm to 11.00 pm. The is no thermostat in any typical room of school.

**5- CLASS OPERATION CONDITIONS**

The main air temperature in class was measured from 19-22 °C during winter. Good thermal confort contitions. Low air quality conditions because the classroom are to small without fresh air system

**PROPOSALS FOR UPGRATE**

1) Maintenance and regulation of heating system in order to reduce high exhaust gas temperature
2) Thermal Insulation of pipes and fittings inside the mechanical room
3) Installation of air quality data loger to monitor air quality problems
4) Installation of presence detectors in order to control lighiting system and Air Conditions in teachers room

## GENERAL INFORMATION

| | |
|---|---|
| School Name | 21 Primary School |
| School Type | Primary School |
| Andrees | 43, Kyprou St, 11253, Athens |
| Director | Foutsitzi Chrisoula |
| Tel | 2108652643 |
| website | https://blogs.sch.gr/21dimath/ |
| email | mail@21dim-athin.att.sch.gr |
| Pupils/ Students | 180 |
| Teachers | 18 |
| Total Users | 198 |


## BUILING DATA

| | |
|---|---|
| YEAR OF CONTRUCNTION | 1899 / 2006 |
| RENOVATION YEAR. | 1967 |
| BUILDING PARTS | 2 |
| BUILDING FLOORS | 3 |
| TOTAL S.M. | 1690 |
| m²/ STUDEN | 9.39 |
| m²/ USER | 8.54 |

| LEVEL | AREA (m²) | CLASS ROOM |
|---|---|---|
| -1 FLOOR | 260 | |
| 0 FLOOR | 540 | |
| 1th FLOOR | 540 | |
| 2th FLOOR | 350 | |
| 3th FLOOR | - | |
| 4th FLOOR | - | |
| SUM | 1690 | 0.00 |

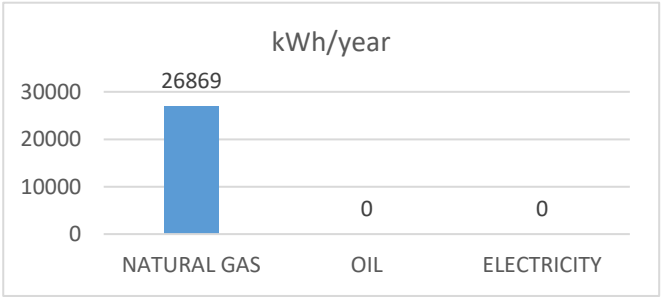
## BUILDING CONSTUCTION QUALITY

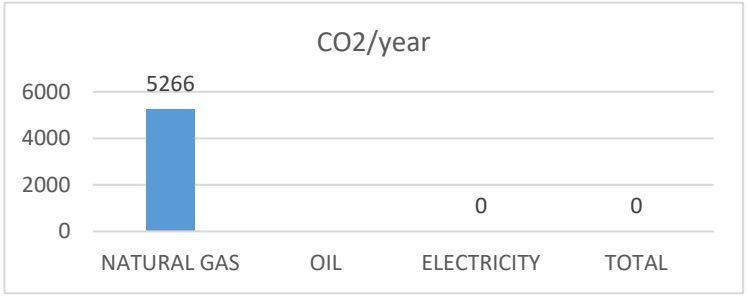
| | DESCRIPTION |
|---|---|
| FOOTINGS | Uninsulated Concrete |
| WALLS | Stone |
| BEAMS | |
| ROOF | Roof with tile |
| WINDOWS | Single Glass Wooden Frame |
| DOORS | Iron made doors, with 20% of single glass |
| SHADING | internal shading - courtains |
| Notes | |

## ENERGY CONSUMPTION DATA - SPECIFIC VALUES

| CONSUMPTIONS | 2016 | 2017 | 2018 | 2019 | AVERAGE | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 26869 | NA | NA | NA | 26869 | kWh(th)/year |
| OIL | 0 | 0 | 0 | 0 | 0 | lt/year |
| ELECTRICITY | NA | NA | NA | NA | #ΣΥΝΔΕΣΗ! | kWh(el)/year |

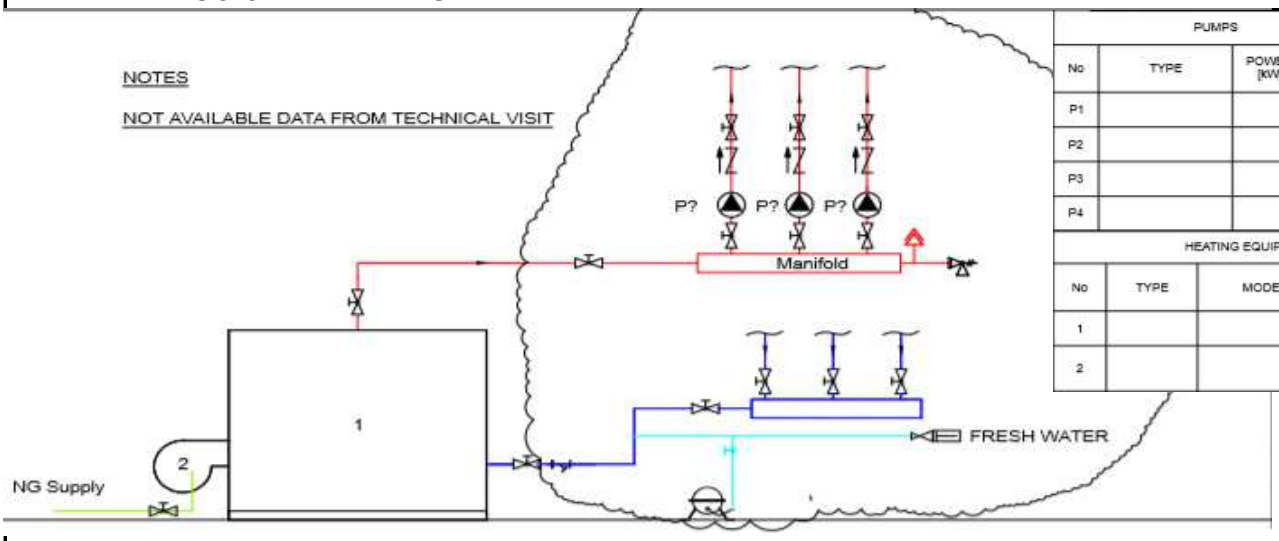
| SPECIFIC ENERGY | Per Building Area | | Per User | | CO2 EMISSIONS | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 15.90 | kWh(th)/y.s.m | 135.702 | kWh(th)/y.user | 5266 | kg CO2/Year |
| OIL | 0.00 | lt/year.s.m | 0.000 | lt/y.user | | kg CO2/Year |
| ELECTRICITY | #ΣΥΝΔΕΣΗ! | kWh(el)/y.s.m | #ΣΥΝΔΕΣΗ! | kWh(el)/y.user | #ΣΥΝΔΕΣΗ! | kg CO2/Year |
| | | | | TOTAL | #ΣΥΝΔΕΣΗ! | kg CO2/Year |



## HEATING SYSTEM DESCRIPTION

### DRAFT HEATING SYSTEM DRAWING




| PUMPS | | | | |
|---|---|---|---|---|
| No | TYPE | POWER [kW] | FLOW [m3/h] | HEAD [m] |
| P1 | | | | |
| P2 | | | | |
| P3 | | | | |
| P4 | | | | |

| HEATING EQUIPMENT | | | |
|---|---|---|---|
| No | TYPE | MODEL | HEATING POWER [kW] |
| 1 | | | |
| 2 | | | |

| | | | |
|---|---|---|---|
| FUEL TYPE | GASS | PRODUCT DESCRIPTION | |
| BOILER 1 | 0 kW | 0 | |
| BOILER 2 | kW | | |
| BOILER 3 | kW | | |
| BURNER 1 | 0 kW | 0 | |
| BURNER 2 | kW | | |
| BURNER 3 | kW | | |
| | | TOTAL | 0 kW(thl) |

| CIRCULATORS | TYPE | Head [m] | flow [m³/h] | EL.DATA [kW] |
|---|---|---|---|---|
| PUMP 1 | | | | |
| PUMP 2 | | | | |
| PUMP 3 | | | | |
| PUMP 4 | | | | |
| PUMP 5 | | | | |
| PUMP 6 | | | | |
| | | | TOTAL | 0 kW(el) |

| MEASUREMENTS (AVARAGE VALUE FROM AVAILABLE DATA) | | | | | | |
|---|---|---|---|---|---|---|
| | HEATING SYSTEM 1 | | HEATING SYSTEM 2 | | HEATING SYSTEM 3 | |
| EXHAUST GAS TEMP. | 0 | °C | | °C | | °C |
| CARBON MONOXIDE | 0 | ppm | | ppm | | ppm |
| OXIDE OF NITROGEN | 0 | ppm | | ppm | | ppm |
| OXIGEN | 0 | % | | % | | % |
| CARBON DIOXIDE | 0 | % | | % | | % |
| GAS PRESSURE | 0 | mbar | | mbar | | mbar |
| OPARATION GAS PRES | 0 | mbar | | mbar | | mbar |
| WATER TEMP. | 0 | °C | | °C | | °C |
| CALCULATIONS | | | | | | |
| EFFICIENT | 0 | % | | % | | % |
| GAS LOSSES | 0 | % | | % | | % |
| GAS SUPPLY | 0 | m3/h | | m3/h | | m3/h |

| | | |
|---|---|---|
| **HEATING CAPACITY / S.M.** | **0.00** | **WATTS/s.m** |

| COOLING SYSTEM | |
|---|---|
| ROOM | TYPE |
| OFFICES | SPLIT UNIT |
| CLASS | NA |
| GYM | NA |
| BOOKSTORE | SPLIT UNIT |
| MULTIPURPOSE HALL | SPLIT UNIT |

| FRESH AIR SYSTEM - VENTILATORS | |
|---|---|
| **ROOM** | **TYPE** |
| OFFICES | FRESH AIR FROM WINDOWS |
| CLASS | FRESH AIR FROM WINDOWS |
| GYM | FRESH AIR FROM WINDOWS |
| BOOKSTORE | FRESH AIR FROM WINDOWS |
| MULTIUSE ROOM | FRESH AIR FROM WINDOWS |

| LIGHITING | |
|---|---|
| **ROOM** | **TYPE** |
| OFFICES | TYPICAL FLUORESCENT LIGHTING |
| CLASS | TYPICAL FLUORESCENT LIGHTING |
| GYM | TYPICAL FLUORESCENT LIGHTING |
| BOOKSTORE | TYPICAL FLUORESCENT LIGHTING |
| MULTIUSE ROOM | TYPICAL FLUORESCENT LIGHTING |

DESCRITPTION OF EQUIPMENT AND OPERATION

HEATING SYSTEM DESCRIPTION

**1 - HEATING PIPE**

**2 - PUMPS**

**3 - CHIMNEY**

**4 - BOILER - BURNER**

**5- CLASS OPERATION CONDITIONS**

**PROPOSALS FOR UPGRATE**

## GENERAL INFORMATION

| | |
|---|---|
| School Name | 39 Primary School |
| School Type | Primary School |
| Andrees | Axarnwn & Tsounta St, 11143, Athens |
| Director | Aloukos Giorgos |
| Tel | 2108652643 |
| website | http://39dim-athin.att.sch.gr/ |
| email | mail@39dim-athin.att.sch.gr |
| Pupils/ Students | 226 |
| Teachers | 33 |
| Total Users | 259 |


## BUILING DATA

| | |
|---|---|
| YEAR OF CONTRUCNTION | 1979 |
| RENOVATION YEAR. | 0 |
| BUILDING PARTS | 3 |
| BUILDING FLOORS | 3 |
| TOTAL S.M. | 2099.43 |
| m²/ STUDEN | 9.29 |
| m²/ USER | 8.11 |

| LEVEL | AREA (m²) | CLASS ROOM |
|---|---|---|
| -1 FLOOR | 0 | |
| 0 FLOOR | 904.07 | |
| 1th FLOOR | 597.68 | |
| 2th FLOOR | 597.68 | |
| 3th FLOOR | 0 | |
| 4th FLOOR | 2099.43 | |
| SUM | 4198.86 | 0.00 |

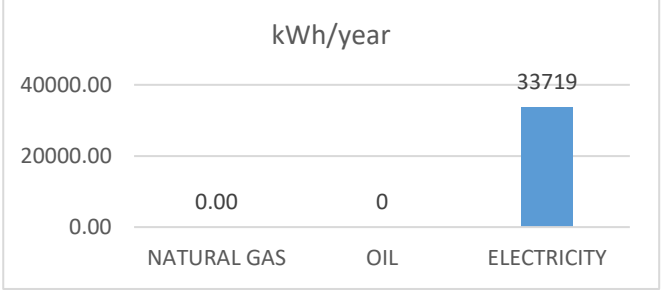
## BUILDING CONSTUCTION QUALITY

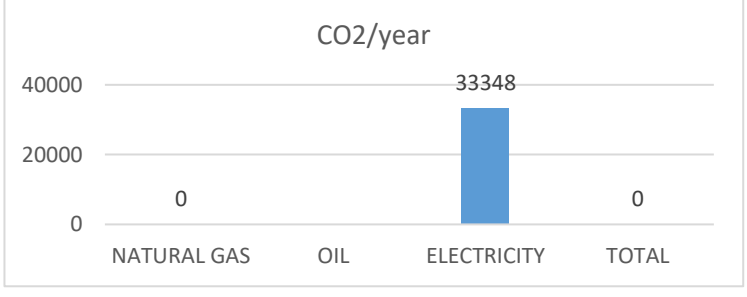
| | DESCRIPTION |
|---|---|
| FOOTINGS | Uninsulated Concrete |
| WALLS | Uninsulated Concrete |
| BEAMS | Uninsulated Concrete |
| ROOF | Waterproof Insulation - Good quallity |
| WINDOWS | Single Glass with Alluminium frame |
| DOORS | Iron made doors, with 10% of single glass |
| SHADING | internal shading - courtains |
| Notes | |

## ENERGY CONSUMPTION DATA - SPECIFIC VALUES

| CONSUMPTIONS | 2016 | 2017 | 2018 | 2019 | AVERAGE | |
|---|---|---|---|---|---|---|
| NATURAL GAS | NA | NA | NA | NA | #ΣΥΝΔΕΣΗ! | kWh(th)/year |
| OIL | 0 | 0 | 0 | 0 | 0 | lt/year |
| ELECTRICITY | NA | 30952 | 36486 | NA | 33719 | kWh(el)/year |

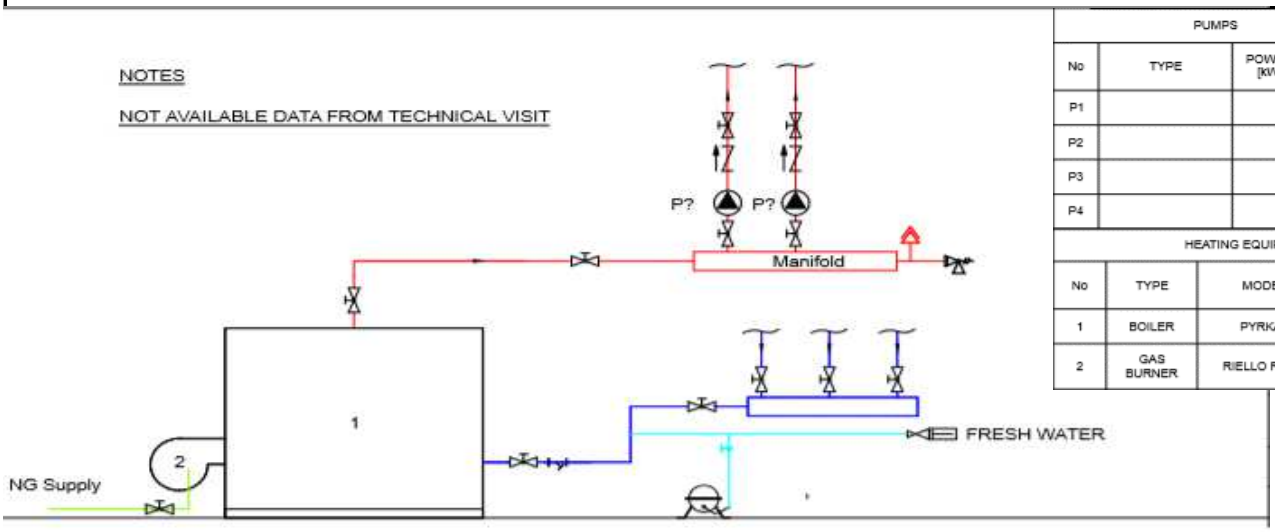
| SPECIFIC ENERGY | Per Building Area | | Per User | | CO2 EMISSIONS | |
|---|---|---|---|---|---|---|
| NATURAL GAS | #ΣΥΝΔΕΣΗ! | kWh(th)/y.s.m | #ΣΥΝΔΕΣΗ! | kWh(th)/y.user | #ΣΥΝΔΕΣΗ! | kg CO2/Year |
| OIL | 0.00 | lt/year.s.m | 0.000 | lt/y.user | | kg CO2/Year |
| ELECTRICITY | 8.03 | kWh(el)/y.s.m | 130.189 | kWh(el)/y.user | 33348 | kg CO2/Year |
| | | | | TOTAL | #ΣΥΝΔΕΣΗ! | kg CO2/Year |



## HEATING SYSTEM DESCRIPTION

### DRAFT HEATING SYSTEM DRAWING




| PUMPS | | | | |
|---|---|---|---|---|
| No | TYPE | POWER [kW] | FLOW [m3/h] | HEAD [m] |
| P1 | | | | |
| P2 | | | | |
| P3 | | | | |
| P4 | | | | |

| HEATING EQUIPMENT | | | |
|---|---|---|---|
| No | TYPE | MODEL | HEATING POWER [kW] |
| 1 | BOILER | PYRKAL | 255 |
| 2 | GAS BURNER | RIELLO RS 5D | 160-206/ 34 |

| | | | |
|---|---|---|---|
| FUEL TYPE | GASS | PRODUCT DESCRIPTION | |
| BOILER 1 | 255.85 kW | PYRKAL | |
| BOILER 2 | kW | | |
| BOILER 3 | kW | | |
| BURNER 1 | 160-208 / 345 kW | RIELLO RS 5D | |
| BURNER 2 | kW | | |
| BURNER 3 | kW | | |
| | | TOTAL | 255.85 kW(thl) |

| CIRCULATORS | TYPE | Head [m] | flow [m³/h] | EL.DATA [kW] |
|---|---|---|---|---|
| PUMP 1 | | | | |
| PUMP 2 | | | | |
| PUMP 3 | | | | |
| PUMP 4 | | | | |
| PUMP 5 | | | | |
| PUMP 6 | | | | |
| | | | TOTAL | 0 kW(el) |

| MEASUREMENTS (AVARAGE VALUE FROM AVAILABLE DATA) | | | | | | |
|---|---|---|---|---|---|---|
| | HEATING SYSTEM 1 | | HEATING SYSTEM 2 | | HEATING SYSTEM 3 | |
| EXHAUST GAS TEMP. | 228.5 | °C | | °C | | °C |
| CARBON MONOXIDE | 14 | ppm | | ppm | | ppm |
| OXIDE OF NITROGEN | 91 | ppm | | ppm | | ppm |
| OXIGEN | 4.5 | % | | % | | % |
| CARBON DIOXIDE | 9.3 | % | | % | | % |
| GAS PRESSURE | 32.5 | mbar | | mbar | | mbar |
| OPARATION GAS PRES | 23 | mbar | | mbar | | mbar |
| WATER TEMP. | 70 | °C | | °C | | °C |
| CALCULATIONS | | | | | | |
| EFFICIENT | 90.4 | % | | % | | % |
| GAS LOSSES | 9.6 | % | | % | | % |
| GAS SUPPLY | 21 | m3/h | | m3/h | | m3/h |

| | | |
|---|---|---|
| **HEATING CAPACITY / S.M.** | **60.93** | **WATTS/s.m** |

**COOLING SYSTEM**

| ROOM | TYPE |
|---|---|
| OFFICES | SPLIT UNIT |
| CLASS | NA |
| GYM | NA |
| BOOKSTORE | SPLIT UNIT |
| MULTIPURPOSE HALL | SPLIT UNIT |

**FRESH AIR SYSTEM - VENTILATORS**

| ROOM | TYPE | |
|---|---|---|
| OFFICES | MECHANICAL VENTILATION | FLUSH MOUNT SEILING FANS |
| CLASS | MECHANICAL VENTILATION | FLUSH MOUNT SEILING FANS |
| GYM | MECHANICAL VENTILATION | |
| BOOKSTORE | MECHANICAL VENTILATION | |
| MULTIUSE ROOM | MECHANICAL VENTILATION | |

**LIGHITING**

| ROOM | TYPE |
|---|---|
| OFFICES | TYPICAL FLUORESCENT LIGHTING |
| CLASS | TYPICAL FLUORESCENT LIGHTING |
| GYM | TYPICAL FLUORESCENT LIGHTING |
| BOOKSTORE | TYPICAL FLUORESCENT LIGHTING |
| MULTIUSE ROOM | TYPICAL FLUORESCENT LIGHTING |

DESCRITPTION OF EQUIPMENT AND OPERATION

HEATING SYSTEM DESCRIPTION

**1 - HEATING PIPE**

Heating pipes are made from black iron in several diameters.

**2 - PUMPS**

**3 - CHIMNEY**

Chimney of boiler is uninsulated and does not cover the national regulation for construction material and external insulation.

**4 - BOILER - BURNER**

Boiler operation temperature is constant all over the heating period. Main Operation temperatures are 65-70 °C.

The control strategy of heating system is: Manual On - Off based on daily schedule.

**5- CLASS OPERATION CONDITIONS**

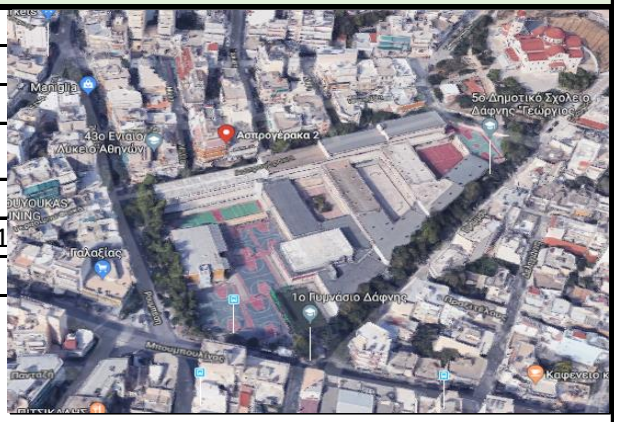
The main air temperature in class was measured from 18-20 °C during winter. Good thermal confort contitions

**PROPOSALS FOR UPGRATE**

1) Installation of two way motorized valve in order to separate the heating system of the two building block
2) Installation thermostat in one typical classroom for each building block - ON/Of motorized valve and boiler
3) Change water taps for demostation
4) Installation of new light (Led) and change the switch on in two rows
5) Maintenance and regulation of mechanical vantillation system

## GENERAL INFORMATION

| | |
|---|---|
| School Name | 43 Gymnasium and Lyceum |
| School Type | Lyceum |
| Andrees | 2, Asprogeraka St, 11744, Athens |
| | |
| Director | Orfanoudaki Eirini |
| Tel | 2108652643 |
| website | http://43gym-athin.att.sch.gr/autosch/joomla1 |
| email | mail@43lyk-athin.att.sch.gr |
| Pupils/ Students | 500 |
| Teachers | 0 |
| Total Users | 500 |




## BUILING DATA

| | |
|---|---|
| YEAR OF CONTRUCNTION | 1972 |
| RENOVATION YEAR. | 0 |
| BUILDING PARTS | 6 |
| BUILDING FLOORS | 3 |
| TOTAL S.M. | 4547.17 |
| m²/ STUDEN | 9.09 |
| m²/ USER | 9.09 |

| LEVEL | AREA (m²) | CLASS ROOM |
|---|---|---|
| -1 FLOOR | 779.27 | |
| 0 FLOOR | 1863.28 | |
| 1th FLOOR | 1184.65 | |
| 2th FLOOR | 719.97 | |
| 3th FLOOR | 0 | |
| 4th FLOOR | 0 | |
| SUM | 4547.17 | 0.00 |

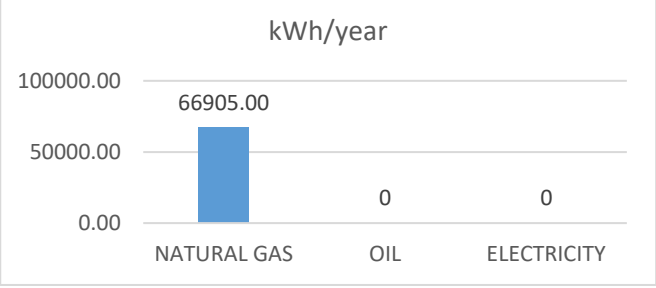
## BUILDING CONSTUCTION QUALITY

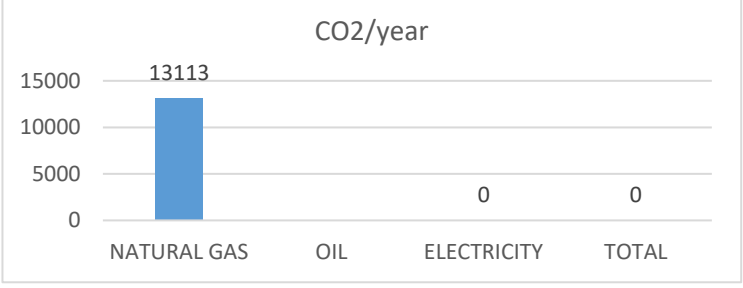
| | DESCRIPTION |
|---|---|
| FOOTINGS | Uninsulated Concrete |
| WALLS | Uninsulated Concrete - Singe brick |
| BEAMS | |
| ROOF | Waterproof Insulation - good quallity |
| WINDOWS | Single Glass aluminium frame |
| DOORS | Iron made doors, with 30% of single glass |
| SHADING | internal shading - courtains |
| Notes | |

## ENERGY CONSUMPTION DATA - SPECIFIC VALUES

| CONSUMPTIONS | 2016 | 2017 | 2018 | 2019 | AVERAGE | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 66905.00 | 82763 | NA | NA | 66905.00 | kWh(th)/year |
| OIL | 0 | 0 | 0 | 0 | 0 | lt/year |
| ELECTRICITY | NA | NA | NA | NA | #ΣΥΝΔΕΣΗ! | kWh(el)/year |

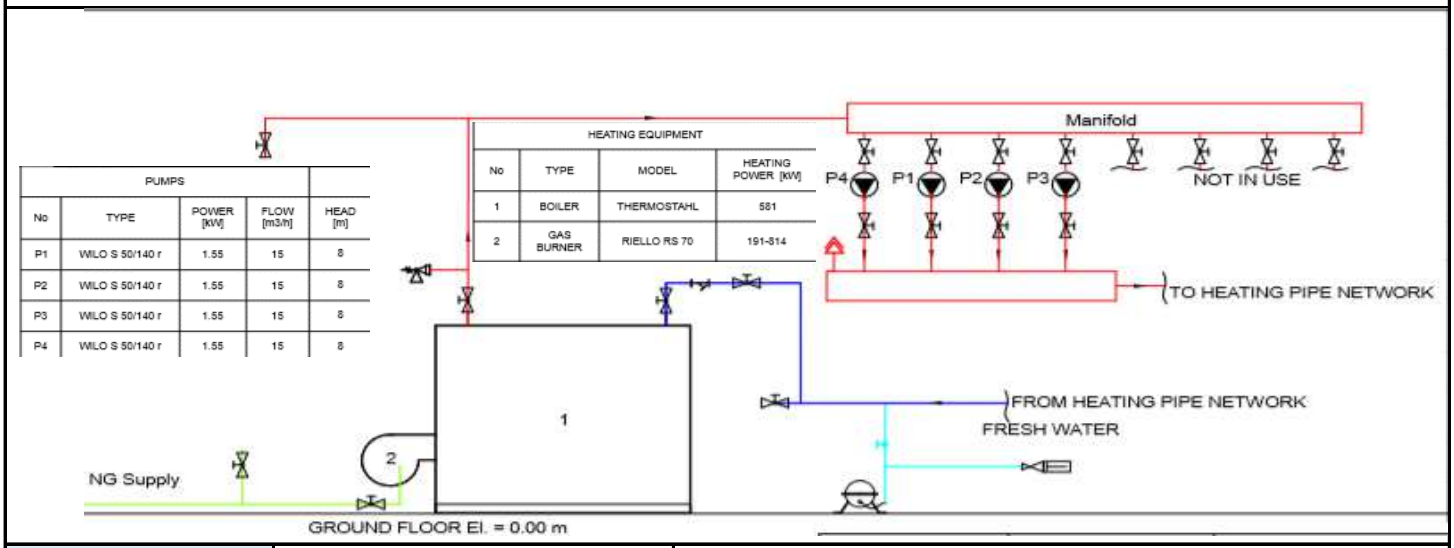
| SPECIFIC ENERGY | Per Building Area | | Per User | | CO2 EMISSIONS | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 14.71 | kWh(th)/y.s.m | 133.810 | kWh(th)/y.user | 13113 | kg CO2/Year |
| OIL | 0.00 | lt/year.s.m | 0.000 | lt/y.user | | kg CO2/Year |
| ELECTRICITY | #ΣΥΝΔΕΣΗ! | kWh(el)/y.s.m | #ΣΥΝΔΕΣΗ! | kWh(el)/y.user | #ΣΥΝΔΕΣΗ! | kg CO2/Year |
| | | | | TOTAL | #ΣΥΝΔΕΣΗ! | kg CO2/Year |



## HEATING SYSTEM DESCRIPTION

### DRAFT HEATING SYSTEM DRAWING




| | | | | |
|---|---|---|---|---|
| FUEL TYPE | GASS | | PRODUCT DESCRIPTION | |
| BOILER 1 | 581 | kW | THERMOSTAHL | |
| BOILER 2 | | kW | | |
| BOILER 3 | | kW | | |
| BURNER 1 | 191-814 | kW | RIELLO RS 70 | |
| BURNER 2 | | kW | | |
| BURNER 3 | | kW | | |
| | | | TOTAL | 581 kW(thl) |

| CIRCULATORS | TYPE | Head [m] | flow [m³/h] | EL.DATA [kW] |
|---|---|---|---|---|
| PUMP 1 | WILO S50/140 r | 8 | 15 | 1550 BUCK UP |
| PUMP 2 | WILO S50/140 r | 8 | 15 | 1550 |
| PUMP 3 | WILO S50/140 r | 8 | 15 | 1550 |
| PUMP 4 | WILO S50/140 r | 8 | 15 | 1550 BUCK UP |
| PUMP 5 | | | | |
| PUMP 6 | | | | |
| | | | TOTAL | 6200 kW(el) |

| MEASUREMENTS (AVARAGE VALUE FROM AVAILABLE DATA) | | | | | | |
|---|---|---|---|---|---|---|
| | HEATING SYSTEM 1 | | HEATING SYSTEM 2 | | HEATING SYSTEM 3 | |
| EXHAUST GAS TEMP. | 210.3 | °C | | °C | | °C |
| CARBON MONOXIDE | 19 | ppm | | ppm | | ppm |
| OXIDE OF NITROGEN | 69 | ppm | | ppm | | ppm |
| OXIGEN | 7.5 | % | | % | | % |
| CARBON DIOXIDE | 9.3 | % | | % | | % |
| GAS PRESSURE | 64.6 | mbar | | mbar | | mbar |
| OPARATION GAS PRES | 40.1 | mbar | | mbar | | mbar |
| WATER TEMP. | 65 | °C | | °C | | °C |
| CALCULATIONS | | | | | | |
| EFFICIENT | 92.1 | % | | % | | % |
| GAS LOSSES | 7.9 | % | | % | | % |
| GAS SUPPLY | 0 | m3/h | | m3/h | | m3/h |
| **HEATING CAPACITY / S.M.** | **127.77** | **WATTS/s.m** | | | | |

**COOLING SYSTEM**

| ROOM | TYPE |
|---|---|
| OFFICES | SPLIT UNIT |
| CLASS | NA |
| GYM | NA |
| BOOKSTORE | NA |
| MULTIPURPOSE HALL | NA |

**FRESH AIR SYSTEM - VENTILATORS**

| ROOM | TYPE |
|---|---|
| OFFICES | FRESH AIR FROM WINDOWS |
| CLASS | FRESH AIR FROM WINDOWS |
| GYM | FRESH AIR FROM WINDOWS |
| BOOKSTORE | FRESH AIR FROM WINDOWS |
| MULTIUSE ROOM | FRESH AIR FROM WINDOWS |

**LIGHITING**

| ROOM | TYPE |
|---|---|
| OFFICES | TYPICAL FLUORESCENT LIGHTING |
| CLASS | TYPICAL FLUORESCENT LIGHTING |
| GYM | TYPICAL FLUORESCENT LIGHTING |
| BOOKSTORE | TYPICAL FLUORESCENT LIGHTING |
| MULTIUSE ROOM | TYPICAL FLUORESCENT LIGHTING |

DESCRITPTION OF EQUIPMENT AND OPERATION

HEATING SYSTEM DESCRIPTION

**1 - HEATING PIPE**

Heating pipes are made from black iron in several diameters. The internal part of pipe network are uninsulated. The external part, has typical armaflex insulation 13mm, without UV protection. This part are damaged and need to be repair.

**2 - PUMPS**

Pumps are constant speed driven and working in paraller without any control (non stop oparation). Should be Immediately change with inverter driven pumps based on EUP 2015 directive.

**3 - CHIMNEY**

Chimney of boiler is uninsulated and does not cover the national regulation for construction material and external insulation.

**4 - BOILER - BURNER**

Boiler operation temperature is constant all over the heating period. Main Operation temperatures are 65-70 °C.

The control strategy of heating system is: Manual On - Off based on daily schedule. Typical operation hours from 7.30 pm to 14.00 pm. The is no thermostat in any typical room of school.

**5- CLASS OPERATION CONDITIONS**

Extremly different temperature per class and per floor.

**PROPOSALS FOR UPGRATE**

1) Thermal Insulation of pipes and fittings inside the mechanical room
2) Maintenance and regulation of heating system in order to reduce high exhaust gas temperature
3) New switch board with timer for heating system should be installed for more efficient operation
4) Installation of new pumps and temperature control of their operation
5) Installation of flush mounted seiling fans in classroom
6) Installation new Air Condition Unit in teachers room - office
7) Installation new Air Condition Unit in PC lab
8) Check and repair the main electrical installation and switchboards per floor

## GENERAL INFORMATION

| | |
|---|---|
| School Name | 40 Primary School |
| School Type | Primary School |
| Andrees | Momferatou & Falireos St, 11475, Athens |
| | |
| Director | Mpoukogianni Marillena |
| Tel | 2108652643 |
| website | https://blogs.sch.gr/40dimat/ |
| email | mail@40dim-athin.att.sch.gr |
| Pupils/ Students | 220 |
| Teachers | 23 |
| Total Users | 243 |


## BUILING DATA

| | |
|---|---|
| YEAR OF CONTRUCNTION | 1991 |
| RENOVATION YEAR. | 0 |
| BUILDING PARTS | 2 |
| BUILDING FLOORS | 3 |
| TOTAL S.M. | 1823.92 |
| m²/ STUDEN | 8.29 |
| m²/ USER | 7.51 |

| LEVEL | AREA (m²) | CLASS ROOM |
|---|---|---|
| -1 FLOOR | 91.54 | |
| 0 FLOOR | 681.9 | |
| 1th FLOOR | 608.55 | |
| 2th FLOOR | 393.96 | |
| 3th FLOOR | 47.97 | |
| 4th FLOOR | - | |
| SUM | 1823.92 | 0.00 |

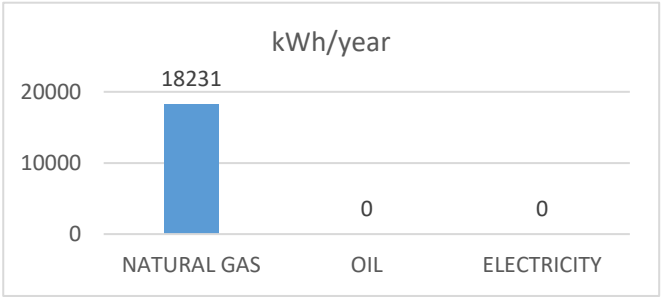
## BUILDING CONSTUCTION QUALITY

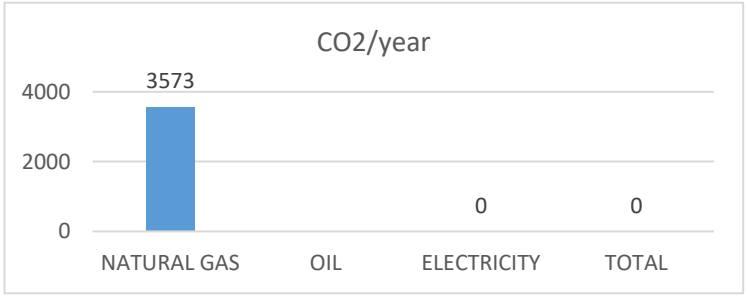
| | DESCRIPTION |
|---|---|
| FOOTINGS | Uninsulated Concrete |
| WALLS | Uninsulated Concrete |
| BEAMS | |
| ROOF | Waterproof Insulation - mean quallity |
| WINDOWS | New double Glass alluminium frame |
| DOORS | Iron made doors, with 20% of single glass |
| SHADING | internal shading - courtains |
| Notes | |

## ENERGY CONSUMPTION DATA - SPECIFIC VALUES

| CONSUMPTIONS | 2016 | 2017 | 2018 | 2019 | AVERAGE | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 17156.00 | 19306.00 | NA | NA | 18231 | kWh(th)/year |
| OIL | 0 | 0 | 0 | 0 | 0 | lt/year |
| ELECTRICITY | NA | NA | NA | NA | #ΣΥΝΔΕΣΗ! | kWh(el)/year |

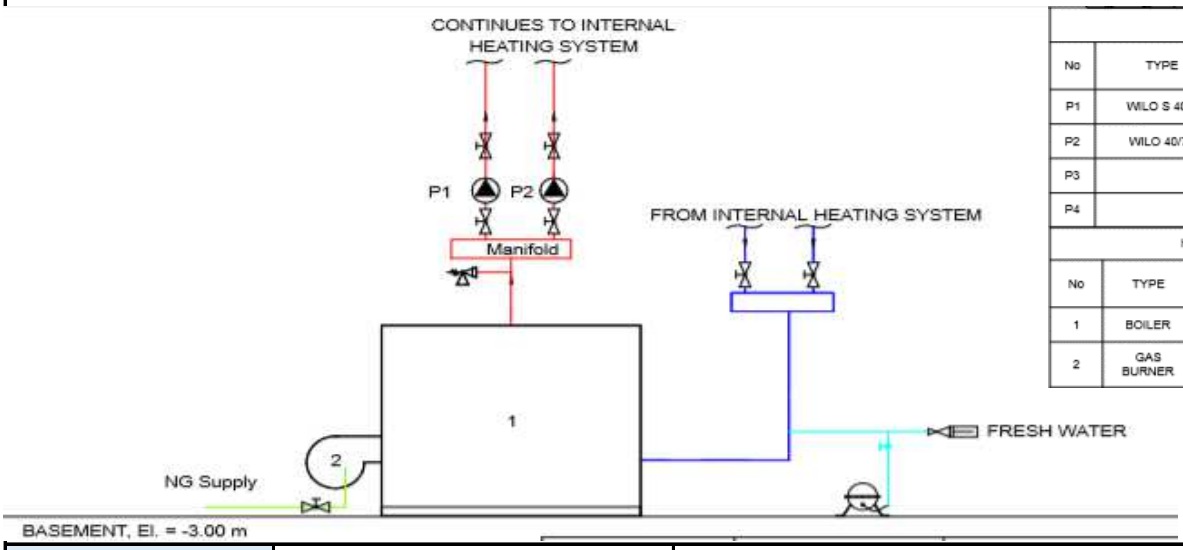
| SPECIFIC ENERGY | Per Building Area | | Per User | | CO2 EMISSIONS | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 10.00 | kWh(th)/y.s.m | 75.025 | kWh(th)/y.user | 3573 | kg CO2/Year |
| OIL | 0.00 | lt/year.s.m | 0.000 | lt/y.user | | kg CO2/Year |
| ELECTRICITY | #ΣΥΝΔΕΣΗ! | kWh(el)/y.s.m | #ΣΥΝΔΕΣΗ! | kWh(el)/y.user | #ΣΥΝΔΕΣΗ! | kg CO2/Year |
| | | | | TOTAL | #ΣΥΝΔΕΣΗ! | kg CO2/Year |



## HEATING SYSTEM DESCRIPTION

### DRAFT HEATING SYSTEM DRAWING




| PUMPS | | | | |
|---|---|---|---|---|
| No | TYPE | POWER [kW] | FLOW [m3/h] | HEAD [m] |
| P1 | WILO S 40/7 | 0.13 | 5 | 4 |
| P2 | WILO 40/70 | 0.255 | 5 | 4 |
| P3 | | | | |
| P4 | | | | |

| HEATING EQUIPMENT | | | |
|---|---|---|---|
| No | TYPE | MODEL | HEATING POWER [kW] |
| 1 | BOILER | UNAME | 140 |
| 2 | GAS BURNER | RIELLO BS 3 | 65-189 |

| | | | | |
|---|---|---|---|---|
| FUEL TYPE | GASS | | PRODUCT DESCRIPTION | |
| BOILER 1 | 140 | kW | UNNAME | |
| BOILER 2 | | kW | | |
| BOILER 3 | | kW | | |
| BURNER 1 | 65-189 | kW | RIELLO BS 3 | |
| BURNER 2 | | kW | | |
| BURNER 3 | | kW | | |
| | | | TOTAL | 140 kW(thl) |

| CIRCULATORS | TYPE | Head [m] | flow [m³/h] | EL.DATA [kW] |
|---|---|---|---|---|
| PUMP 1 | WILLO S - 40/7 | 5.2 | 10 | 0.13 |
| PUMP 2 | WILLO - 40/7 | 5.2 | 10 | 0.226 |
| PUMP 3 | | | | |
| PUMP 4 | | | | |
| PUMP 5 | | | | |
| PUMP 6 | | | | |
| | | | TOTAL | 0.356 kW(el) |

| MEASUREMENTS (AVARAGE VALUE FROM AVAILABLE DATA) | | | | | | |
|---|---|---|---|---|---|---|
| | HEATING SYSTEM 1 | | HEATING SYSTEM 2 | | HEATING SYSTEM 3 | |
| EXHAUST GAS TEMP. | 175 | °C | | °C | | °C |
| CARBON MONOXIDE | 3 | ppm | | ppm | | ppm |
| OXIDE OF NITROGEN | 37 | ppm | | ppm | | ppm |
| OXIGEN | 5.3 | % | | % | | % |
| CARBON DIOXIDE | 8.8 | % | | % | | % |
| GAS PRESSURE | 29.4 | mbar | | mbar | | mbar |
| OPARATION GAS PRES | 22.2 | mbar | | mbar | | mbar |
| WATER TEMP. | 70 | °C | | °C | | °C |
| CALCULATIONS | | | | | | |
| EFFICIENT | 93.1 | % | | % | | % |
| GAS LOSSES | 6.9 | % | | % | | % |
| GAS SUPPLY | 12 | m3/h | | m3/h | | m3/h |
| **HEATING CAPACITY / S.M.** | **76.76** | **WATTS/s.m** | | | | |

**COOLING SYSTEM**

| | |
|---|---|
| ROOM | PART1 |
| OFFICES | SPLIT UNIT |
| CLASS | NA |
| GYM | NA |
| BOOKSTORE | SPLIT UNIT |
| MULTIPURPOSE HALL | SPLIT UNIT |

**FRESH AIR SYSTEM - VENTILATORS**

| ROOM | TYPE | |
|---|---|---|
| OFFICES | MECHANICAL VENTILLATION | FLUSH MOUNTED SEILING FANS |
| CLASS | MECHANICAL VENTILLATION | FLUSH MOUNTED SEILING FANS |
| GYM | MECHANICAL VENTILLATION | FLUSH MOUNTED SEILING FANS |
| BOOKSTORE | MECHANICAL VENTILLATION | FLUSH MOUNTED SEILING FANS |
| MULTIUSE ROOM | MECHANICAL VENTILLATION | FLUSH MOUNTED SEILING FANS |

**LIGHITING**

| ROOM | TYPE |
|---|---|
| OFFICES | TYPICAL FLUORESCENT LIGHTING |
| CLASS | TYPICAL FLUORESCENT LIGHTING |
| GYM | TYPICAL FLUORESCENT LIGHTING |
| BOOKSTORE | TYPICAL FLUORESCENT LIGHTING |
| MULTIUSE ROOM | TYPICAL FLUORESCENT LIGHTING |

DESCRITPTION OF EQUIPMENT AND OPERATION

HEATING SYSTEM DESCRIPTION

**1 - HEATING PIPE**

Heating pipes are made from black iron in several diameters. The internal part of pipe network are uninsulated. The external part, has typical armaflex insulation 13mm, with UV protection.

**2 - PUMPS**

Pumps are constant speed driven and the opperation is controlled by water temperature in supply line of boiler. In case of damage need to be changed from inverter driven pumps based on EUP 2015 directive.

**3 - CHIMNEY**

Chimney of boiler is based on national regulation.

**4 - BOILER - BURNER**

Boiler operation temperature is constant all over the heating period. Main Operation temperatures are 65-70 °C.

The control strategy of heating system is: Manual On - Off based on daily schedule. Typical operation hours from 7.30 pm to 12.00 pm. The is no thermostat in any typical room of school.

**5- CLASS OPERATION CONDITIONS**

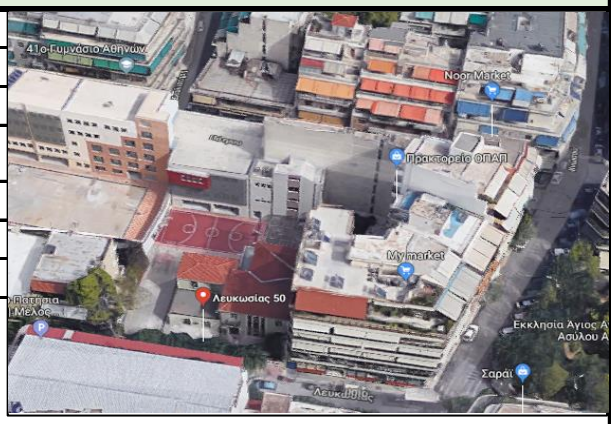
The main air temperature in class was measured from 18-20 °C during winter. Good thermal confort contitions. In each room mechanical ventillation had been installed and occure hight noise during operation. regulation needed.

**PROPOSALS FOR UPGRATE**

1) Maintenance and repair of waterproof roofing system (water insulation)
2) Installation of temperature control unit for heating system based on external conditions in order to avoid overheating of building during hot winder day
3) Maintenance and regulation of mechanical ventillation per classroom
4) Installation data logger for monitoring energy use for heating and electricity

## GENERAL INFORMATION

| | |
|---|---|
| School Name | 22 Primary School |
| School Type | Primary School |
| Andrees | 50, Leukosias St, 11253, Athens |
| | |
| Director | Maganaris Nikolaos |
| Tel | 2108652643 |
| website | http://22dim-athin.att.sch.gr/index.php |
| email | mail@22dim-athin.att.sch.gr |
| Pupils/ Students | 150 |
| Teachers | 22 |
| Total Users | 172 |




## BUILING DATA

| | |
|---|---|
| YEAR OF CONTRUCNTION | 1900 / 2011 |
| RENOVATION YEAR. | 0 |
| BUILDING PARTS | 3 |
| BUILDING FLOORS | 3 |
| TOTAL S.M. | 1290.03 |
| m²/ STUDEN | 8.60 |
| m²/ USER | 7.50 |

| LEVEL | AREA (m²) | CLASS ROOM |
|---|---|---|
| -1 FLOOR | 36.6 | |
| 0 FLOOR | 408.89 | |
| 1th FLOOR | 473.81 | |
| 2th FLOOR | 335.17 | |
| 3th FLOOR | 35.56 | |
| 4th FLOOR | - | |
| SUM | 1290.03 | 0.00 |

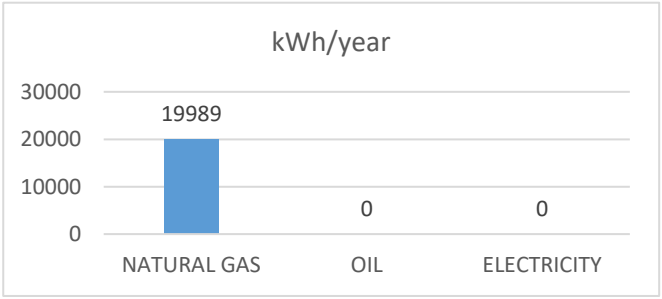
## BUILDING CONSTUCTION QUALITY

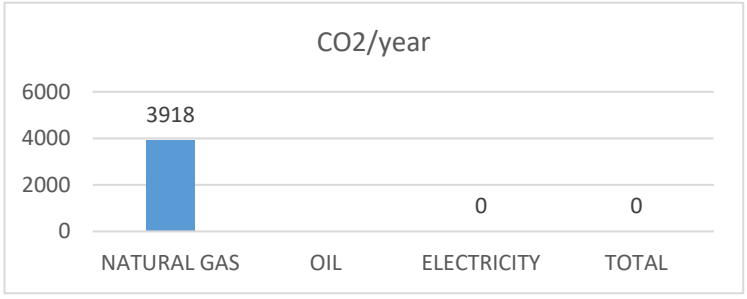
| | DESCRIPTION OLD BUILDING | DESCRIPTION NEW BUILDING |
|---|---|---|
| FOOTINGS | | Concrete |
| WALLS | Stone | Concrete |
| BEAMS | | |
| ROOF | Roof with tile | Waterproof Insulation - good quallity |
| WINDOWS | Double glass - aluminum frame | New double Glass aluminium frame |
| DOORS | Iron made doors, with 20% of single glass | Iron made doors, with 20% of single glass |
| SHADING | internal shading - courtains | internal shading - courtains |
| Notes | | |

## ENERGY CONSUMPTION DATA - SPECIFIC VALUES

| CONSUMPTIONS | 2016 | 2017 | 2018 | 2019 | AVERAGE | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 19989.00 | 17468 | NA | NA | 19989 | kWh(th)/year |
| OIL | 0 | 0 | 0 | 0 | 0 | lt/year |
| ELECTRICITY | NA | NA | NA | NA | #ΣΥΝΔΕΣΗ! | kWh(el)/year |

| SPECIFIC ENERGY | Per Building Area | | Per User | | CO2 EMISSIONS | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 15.49 | kWh(th)/y.s.m | 116.215 | kWh(th)/y.user | 3918 | kg CO2/Year |
| OIL | 0.00 | lt/year.s.m | 0.000 | lt/y.user | | kg CO2/Year |
| ELECTRICITY | #ΣΥΝΔΕΣΗ! | kWh(el)/y.s.m | #ΣΥΝΔΕΣΗ! | kWh(el)/y.user | #ΣΥΝΔΕΣΗ! | kg CO2/Year |
| | | | | TOTAL | #ΣΥΝΔΕΣΗ! | kg CO2/Year |



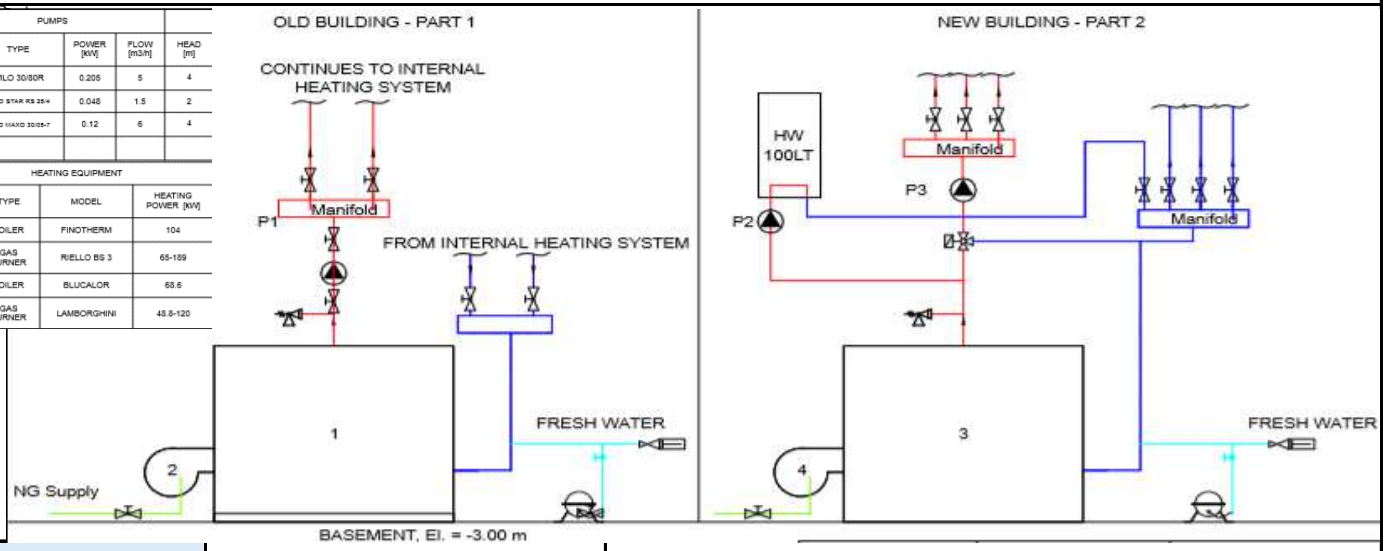



## HEATING SYSTEM DESCRIPTION

### DRAFT HEATING SYSTEM DRAWING

| PUMPS | | | | |
|---|---|---|---|---|
| No | TYPE | POWER [kW] | FLOW [m3/h] | HEAD [m] |
| P1 | WILO 30/80R | 0.205 | 5 | 4 |
| P2 | WILO STAR RS 25/4 | 0.048 | 1.5 | 2 |
| P3 | WILO MAXO 30/05-7 | 0.12 | 6 | 4 |
| P4 | | | | |

| HEATING EQUIPMENT | | | |
|---|---|---|---|
| No | TYPE | MODEL | HEATING POWER [kW] |
| 1 | BOILER | FINOTHERM | 104 |
| 2 | GAS BURNER | RIELLO BS 3 | 65-189 |
| 3 | BOILER | BLUCALOR | 68.6 |
| 4 | GAS BURNER | LAMBORGHINI | 48.8-120 |




| | | | | |
|---|---|---|---|---|
| FUEL TYPE | GASS | | PRODUCT DESCRIPTION | |
| BOILER 1 | 104 | kW | FINOTHERM | |
| BOILER 2 | 68.6 | kW | BLUCALOR | |
| BOILER 3 | | kW | | |
| BURNER 1 | 65-189 | kW | RIELLO BS 3 | |
| BURNER 2 | 49.8-120 | kW | LAMBORGHINI | |
| BURNER 3 | | kW | | |
| | | | TOTAL | 172.6 kW(thl) |

| CIRCULATORS | TYPE | Head [m] | flow [m³/h] | EL.DATA [kW] |
|---|---|---|---|---|
| PUMP 1 | WILO 30/80 R | | | 0.205 |
| PUMP 2 | WILO STAR RS 25/4 | 2 | 1.5 | 0.048 |
| PUMP 3 | WILO MAXO 30/05-7 | 4 | 6 | 0.12 |
| PUMP 4 | | | | |
| PUMP 5 | | | | |
| PUMP 6 | | | | |
| | | | TOTAL | 0.373 kW(el) |

| MEASUREMENTS (AVARAGE VALUE FROM AVAILABLE DATA) | | | | | | |
|---|---|---|---|---|---|---|
| | HEATING SYSTEM 1 | | HEATING SYSTEM 2 | | HEATING SYSTEM 3 | |
| EXHAUST GAS TEMP. | 189.9 | °C | NA | °C | | °C |
| CARBON MONOXIDE | 39 | ppm | NA | ppm | | ppm |
| OXIDE OF NITROGEN | 21 | ppm | NA | ppm | | ppm |
| OXIGEN | 6 | % | NA | % | | % |
| CARBON DIOXIDE | 8.5 | % | NA | % | | % |
| GAS PRESSURE | 27.4 | mbar | NA | mbar | | mbar |
| OPARATION GAS PRES | 19.6 | mbar | NA | mbar | | mbar |
| WATER TEMP. | 70 | °C | NA | °C | | °C |
| CALCULATIONS | | | | | | |
| EFFICIENT | 92.2 | % | NA | % | | % |
| GAS LOSSES | 7.8 | % | NA | % | | % |
| GAS SUPPLY | 8 | m3/h | NA | m3/h | | m3/h |
| **HEATING CAPACITY / S.M.** | **133.80** | **WATTS/s.m** | | | | |

**COOLING SYSTEM**

| ROOM | PART 1 (OLD) | PART 2 (NEW) |
|---|---|---|
| OFFICES | SPLIT UNIT | VRV |
| CLASS | NA | VRV |
| GYM | NA | VRV |
| BOOKSTORE | SPLIT UNIT | VRV |
| MULTIPURPOSE HALL | SPLIT UNIT | VRV |

**FRESH AIR SYSTEM - VENTILATORS**

| ROOM | TYPE | |
|---|---|---|
| OFFICES | FRESH AIR FROM WINDOWS | FLUSH MOUNTED SEILING FANS |
| CLASS | FRESH AIR FROM WINDOWS | FLUSH MOUNTED SEILING FANS |
| GYM | FRESH AIR FROM WINDOWS | FLUSH MOUNTED SEILING FANS |
| BOOKSTORE | FRESH AIR FROM WINDOWS | FLUSH MOUNTED SEILING FANS |
| MULTIUSE ROOM | FRESH AIR FROM WINDOWS | FLUSH MOUNTED SEILING FANS |

**LIGHITING**

| ROOM | TYPE |
|---|---|
| OFFICES | TYPICAL FLUORESCENT LIGHTING |
| CLASS | TYPICAL FLUORESCENT LIGHTING |
| GYM | TYPICAL FLUORESCENT LIGHTING |
| BOOKSTORE | TYPICAL FLUORESCENT LIGHTING |
| MULTIUSE ROOM | TYPICAL FLUORESCENT LIGHTING |

DESCRITPTION OF EQUIPMENT AND OPERATION

HEATING SYSTEM DESCRIPTION

**1 - HEATING PIPE**

Old building: Heating pipes are made from black iron in several diameters. The internal part of pipe network are uninsulated. New building: Heating pipes are made from cupper and is well insulated

**2 - PUMPS**

Old Building: Pumps are constant speed driven and the opperation is controlled by water temperature in supply line of boiler. In case of damage need to be changed from inverter driven pumps based on EUP 2015 directive. New Building: Pumps are inverter driven pumps and controll from thermostat and timer.

**3 - CHIMNEY**

Old Building: Chimney of boiler is uninsulated and does not cover the national regulations for construction material and external insulation. New Building: Chimey cover the national regylations.

**4 - BOILER - BURNER**

Old Building: Boiler operation temperature is constant all over the heating period. Main Operation temperatures are 65-70 °C. New building the boiler it is not opperate. Heating of building covered from VRV

The control strategy of heating system is: Manual On - Off based on daily schedule. Typical operation hours from 7.30 pm to 12.00 pm.

**5- CLASS OPERATION CONDITIONS**

The main air temperature in class was measured from 18-20 °C during winder. Good thermal confort contitions

**PROPOSALS FOR UPGRATE**

New Building
1) Maintenance and repair heating system
2) Maintenance of VRV for cooling and heating. Clean the air filters to upgrade air quality.

Old Building
1) New switch board with timer for heating system should be installed for more efficient operation
2) Installation of temperature control unit for heating system based on external conditions in order to avoid overheating of building during hot winder day

## GENERAL INFORMATION

| | |
|---|---|
| School Name | 14 Lyceum |
| School Type | Primary School |
| Andrees | Sikelias & Aglayroy St, 11741, Athens |
| Director | Mavrogiannakis Leonidas |
| Tel | 2108652643 |
| website | http://14lyk-athin.att.sch.gr/wp3/ |
| email | mail@14lyk-athin.att.sch.gr |
| Pupils/ Students | 196 |
| Teachers | 21 |
| Total Users | 42 |


## BUILING DATA

| | |
|---|---|
| YEAR OF CONTRUCNTION | 1982/ 2000 |
| RENOVATION YEAR. | |
| BUILDING PARTS | 3 |
| BUILDING FLOORS | 3 |
| TOTAL S.M. | 3314.48 |
| m²/ STUDEN | 16.91 |
| m²/ USER | 78.92 |

| LEVEL | AREA (m²) | CLASS ROOM |
|---|---|---|
| -1 FLOOR | 285.86 | |
| 0 FLOOR | 1053.9 | |
| 1th FLOOR | 965.87 | |
| 2th FLOOR | 965.87 | |
| 3th FLOOR | 42.98 | |
| 4th FLOOR | 0 | |
| SUM | 3314.48 | 9.00 |

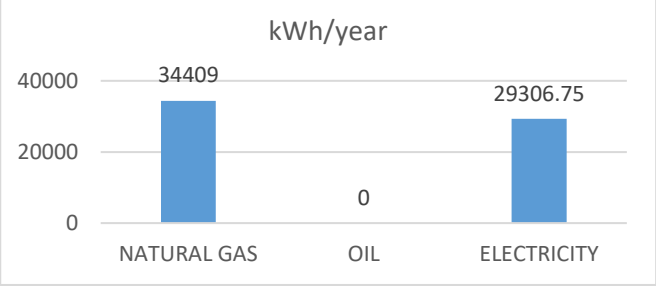
## BUILDING CONSTUCTION QUALITY

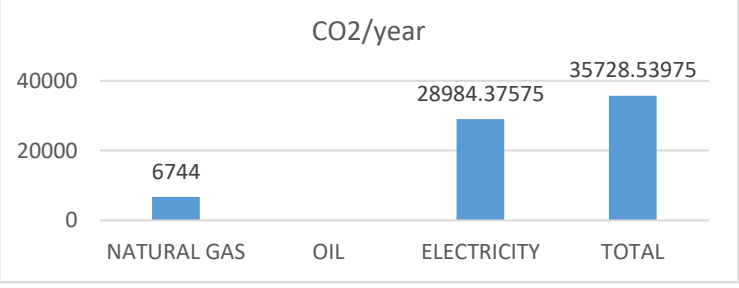
| | DESCRIPTION OLD BUILDING | DESCRIPTION OLD BUILDING |
|---|---|---|
| FOOTINGS | Uninsulated Concrete | na data |
| WALLS | Uninsulated Concrete | Insulated Concrete |
| BEAMS | Uninsulated Concrete | Insulated Concrete |
| ROOF | Waterproof Insullation - Good quallity | Waterproof Insulation - Good quallity |
| WINDOWS | Single Glass with Aluminium frame | Double Glass with Aluminium frame |
| DOORS | Iron made doors, with 10% of single glass | Iron made doors, with 30% of single glass |
| SHADING | internal shading - courtains | internal shading - courtains |
| Notes | | |

## ENERGY CONSUMPTION DATA - SPECIFIC VALUES

| CONSUMPTIONS | 2016 | 2017 | 2018 | 2019 | AVERAGE | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 32400 | 36418.00 | NA | NA | 34409 | kWh(th)/year |
| OIL | 0 | 0 | 0 | 0 | 0 | lt/year |
| ELECTRICITY | NA | 17395 | 41218.5 | NA | 29306.75 | kWh(el)/year |

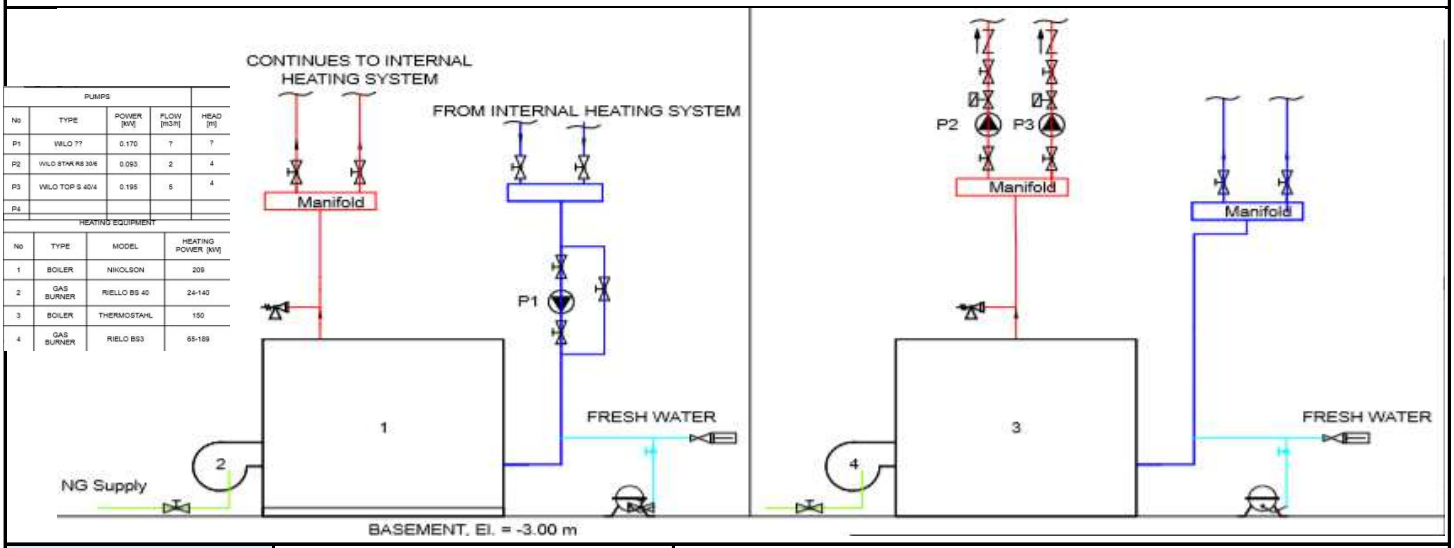
| SPECIFIC ENERGY | Per Building Area | | Per User | | CO2 EMISSIONS | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 10.38 | kWh(th)/y.s.m | 819.262 | kWh(th)/y.user | 6744 | kg CO2/Year |
| OIL | 0.00 | lt/year.s.m | 0.000 | lt/y.user | | kg CO2/Year |
| ELECTRICITY | 8.84 | kWh(el)/y.s.m | 697.780 | kWh(el)/y.user | 28984.37575 | kg CO2/Year |
| | | | | TOTAL | 35728.53975 | kg CO2/Year |



## HEATING SYSTEM DESCRIPTION

### DRAFT HEATING SYSTEM DRAWING




| | | | |
|---|---|---|---|
| FUEL TYPE | GASS | PRODUCT DESCRIPTION | |
| BOILER 1 | 209 kW | NIKOLSON | |
| BOILER 2 | 150 kW | THERMOSTAHL | |
| BOILER 3 | kW | | |
| BURNER 1 | 24-140 kW | RIELLO BS 40 | |
| BURNER 2 | 65-189 kW | RIELLO BS 3 | |
| BURNER 3 | kW | | |
| | | TOTAL | 359 kW(thl) |

| CIRCULATORS | TYPE | Head [m] | flow [m³/h] | EL.DATA [kW] |
|---|---|---|---|---|
| PUMP 1 | WILLO | | | 0.17 |
| PUMP 2 | WILLO STAR RS 30/6 | 4 | 2 | 0.093 |
| PUMP 3 | WILO TOP S 40/4 | 4 | 5 | 0.195 |
| PUMP 4 | | | | |
| PUMP 5 | | | | |
| PUMP 6 | | | | |
| | | | TOTAL | 0.458 kW(el) |

MEASUREMENTS (AVARAGE VALUE FROM AVAILABLE DATA)

| | HEATING SYSTEM 1 | | HEATING SYSTEM 2 | | HEATING SYSTEM 3 | |
|---|---|---|---|---|---|---|
| EXHAUST GAS TEMP. | 219.9 | °C | 219.9 | °C | | °C |
| CARBON MONOXIDE | 33 | ppm | 3.3 | ppm | | ppm |
| OXIDE OF NITROGEN | 38 | ppm | 38 | ppm | | ppm |
| OXIGEN | 4.2 | % | 4.8 | % | | % |
| CARBON DIOXIDE | 9.1 | % | 9.1 | % | | % |
| GAS PRESSURE | 28.7 | mbar | 23.7 | mbar | | mbar |
| OPARATION GAS PRES | 19.9 | mbar | 19.5 | mbar | | mbar |
| WATER TEMP. | 67 | °C | 66 | °C | | °C |
| CALCULATIONS | | | | | | |
| EFFICIENT | 91.5 | % | 91.5 | % | | % |
| GAS LOSSES | 8.5 | % | 8.5 | % | | % |
| GAS SUPPLY | 19.2 | m3/h | 13 | m3/h | | m3/h |

| | | |
|---|---|---|
| **HEATING CAPACITY / S.M.** | **108.31** | **WATTS/s.m** |

**COOLING SYSTEM**

| ROOM | TYPE |
|---|---|
| OFFICES | SPLIT UNIT |
| CLASS | NA |
| GYM | NA |
| BOOKSTORE | SPLIT UNIT |
| MULTIPURPOSE HALL | SPLIT UNIT |

**FRESH AIR SYSTEM - VENTILATORS**

| ROOM | TYPE |
|---|---|
| OFFICES | FRESH AIR FROM WINDOWS |
| CLASS | FRESH AIR FROM WINDOWS |
| GYM | FRESH AIR FROM WINDOWS |
| BOOKSTORE | FRESH AIR FROM WINDOWS |
| MULTIUSE ROOM | FRESH AIR FROM WINDOWS |

**LIGHITING**

| ROOM | TYPE |
|---|---|
| OFFICES | TYPICAL FLUORESCENT LIGHTING |
| CLASS | TYPICAL FLUORESCENT LIGHTING |
| GYM | TYPICAL FLUORESCENT LIGHTING |
| BOOKSTORE | TYPICAL FLUORESCENT LIGHTING |
| MULTIUSE ROOM | TYPICAL FLUORESCENT LIGHTING |

DESCRITPTION OF EQUIPMENT AND OPERATION

HEATING SYSTEM DESCRIPTION

**1 - HEATING PIPE**

Heating pipes are made from black iron in several diameters. The internal part of pipe network are uninsulated.

**2 - PUMPS**

Pumps are constant speed driven and the opperation is controlled by water temperature in supply line of boiler. In case of damage need to be changed from inverter driven pumps based on EUP 2015 directive.

**3 - CHIMNEY**

Chimney of boiler is uninsulated and does not cover the national regulation for construction material and external insulation.

**4 - BOILER - BURNER**

Boiler operation temperature is constant all over the heating period. Main Operation temperatures are 65-70 °C.

The control strategy of heating system is: Manual On - Off based on daily schedule. Typical operation hours from 7.30 pm to 10.30 pm. The is no thermostat in any typical room of school.

**5- CLASS OPERATION CONDITIONS**

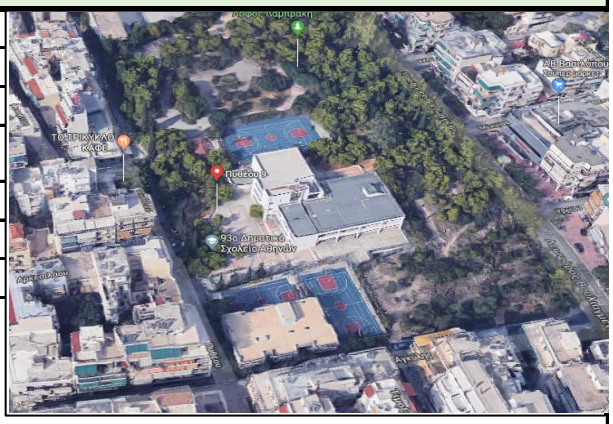
The main air temperature in class was measured from 13-16 °C during winder. Very bud thermal confort contitions due to operation strategy

**PROPOSALS FOR UPGRATE**

1) New switch board with timer for heating system should be installed for more efficient operation
2) Installation of temperature control unit for heating system in bouth buildings, based on external conditions in order to avoid extremly low temperature in some cases.
3) Change lighting system in old building

## GENERAL INFORMATION

| | |
|---|---|
| School Name | 93 Primary School |
| School Type | Primary School |
| Andrees | 9, Pytheoy St, 11743, Athens |
| Director | Protapappa Stalla |
| Tel | 2108652643 |
| website | https://blogs.sch.gr/93dimath/ |
| email | mail@93dim-athin.att.sch.gr |
| Pupils/ Students | 374 |
| Teachers | 27 |
| Total Users | 401 |



## BUILING DATA

| | |
|---|---|
| YEAR OF CONTRUCNTION | 1900 / 2011 |
| RENOVATION YEAR. | 0 |
| BUILDING PARTS | 2 |
| BUILDING FLOORS | 3 |
| TOTAL S.M. | 2760 |
| m²/ STUDEN | 6.88 |
| m²/ USER | 6.88 |

| LEVEL | AREA (m²) | CLASS ROOM |
|---|---|---|
| -1 FLOOR | 330 | |
| 0 FLOOR | 1030 | |
| 1th FLOOR | 1030 | |
| 2th FLOOR | 370 | |
| 3th FLOOR | 0 | |
| 4th FLOOR | - | |
| SUM | 2760 | 0.00 |

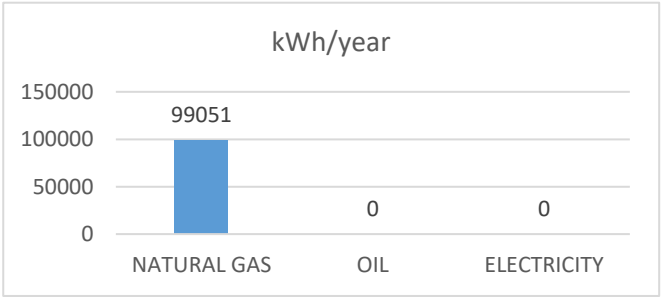
## BUILDING CONSTUCTION QUALITY

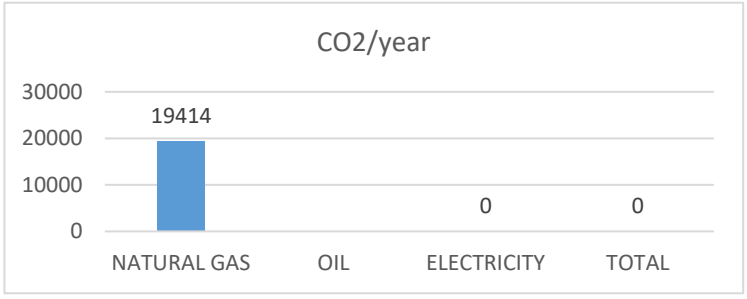
| | DESCRIPTION |
|---|---|
| FOOTINGS | Uninsulated Concrete |
| WALLS | double bricks |
| BEAMS | Uninsulated Concrete |
| ROOF | Waterproof Insulation - Very bad quality |
| WINDOWS | Single Glass with Aluminium frame |
| DOORS | Iron made doors, with 10% of single glass |
| SHADING | internal shading - courtains |
| Notes | |

## ENERGY CONSUMPTION DATA - SPECIFIC VALUES

| CONSUMPTIONS | 2016 | 2017 | 2018 | 2019 | AVERAGE | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 99051.00 | 93857 | NA | NA | 99051 | kWh(th)/year |
| OIL | 0 | 0 | 0 | 0 | 0 | lt/year |
| ELECTRICITY | NA | NA | NA | NA | #ΣΥΝΔΕΣΗ! | kWh(el)/year |

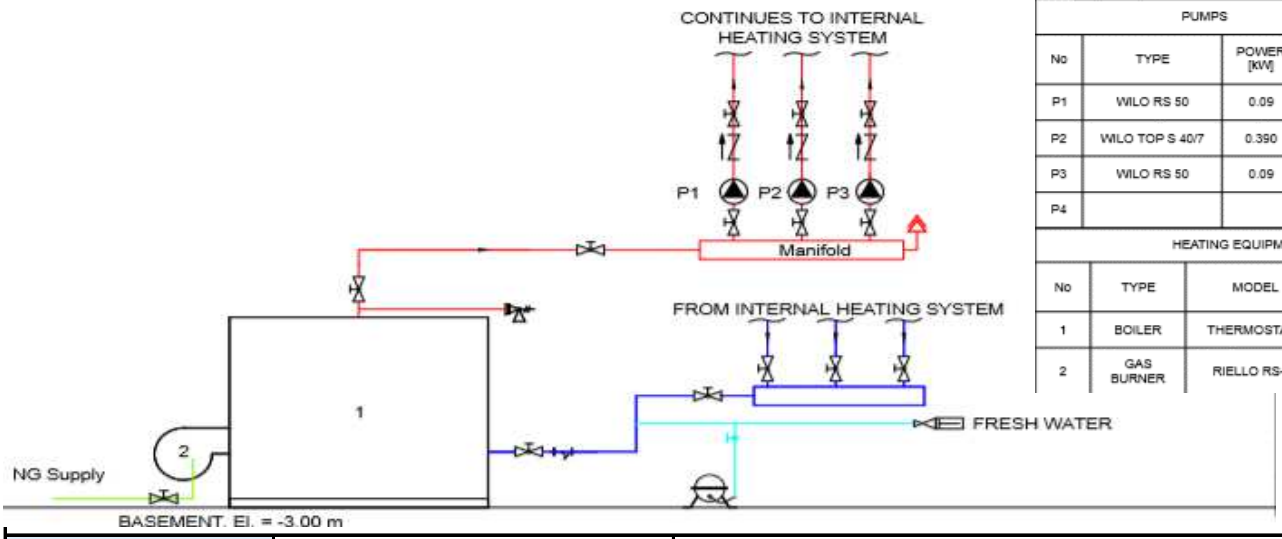
| SPECIFIC ENERGY | Per Building Area | | Per User | | CO2 EMISSIONS | |
|---|---|---|---|---|---|---|
| NATURAL GAS | 35.89 | kWh(th)/y.s.m | 247.010 | kWh(th)/y.user | 19414 | kg CO2/Year |
| OIL | 0.00 | lt/year.s.m | 0.000 | lt/y.user | | kg CO2/Year |
| ELECTRICITY | #ΣΥΝΔΕΣΗ! | kWh(el)/y.s.m | #ΣΥΝΔΕΣΗ! | kWh(el)/y.user | #ΣΥΝΔΕΣΗ! | kg CO2/Year |
| | | | | TOTAL | #ΣΥΝΔΕΣΗ! | kg CO2/Year |



## HEATING SYSTEM DESCRIPTION

### DRAFT HEATING SYSTEM DRAWING




| PUMPS | | | | |
|---|---|---|---|---|
| No | TYPE | POWER [kW] | FLOW [m3/h] | HEAD [m] |
| P1 | WILO RS 50 | 0.09 | 3 | 4 |
| P2 | WILO TOP S 40/7 | 0.390 | 6 | 5 |
| P3 | WILO RS 50 | 0.09 | 3 | 4 |
| P4 | | | | |

| HEATING EQUIPMENT | | | |
|---|---|---|---|
| No | TYPE | MODEL | HEATING POWER [kW] |
| 1 | BOILER | THERMOSTAHL | 407 |
| 2 | GAS BURNER | RIELLO RS-38 | 104-440 |

| | | | | |
|---|---|---|---|---|
| FUEL TYPE | GASS | | PRODUCT DESCRIPTION | |
| BOILER 1 | 407 | kW | THERMOSTAHL | |
| BOILER 2 | | kW | | |
| BOILER 3 | | kW | | |
| BURNER 1 | 105-440 | kW | RIELLO RS 38 | |
| BURNER 2 | | kW | | |
| BURNER 3 | | kW | | |
| | | | TOTAL | 407 kW(thl) |

| CIRCULATORS | TYPE | Head [m] | flow [m³/h] | EL.DATA [kW] |
|---|---|---|---|---|
| PUMP 1 | WILO RS 50 | | | 0.09 |
| PUMP 2 | WILO TOP S 40/7 | | | 0.39 |
| PUMP 3 | WILO RS 50 | | | 0.09 |
| PUMP 4 | | | | |
| PUMP 5 | | | | |
| PUMP 6 | | | | |
| | | | TOTAL | 0.57 kW(el) |

| MEASUREMENTS (AVARAGE VALUE FROM AVAILABLE DATA) | | | | | | |
|---|---|---|---|---|---|---|
| | HEATING SYSTEM 1 | | HEATING SYSTEM 2 | | HEATING SYSTEM 3 | |
| EXHAUST GAS TEMP. | 195.7 | °C | | °C | | °C |
| CARBON MONOXIDE | 0 | ppm | | ppm | | ppm |
| OXIDE OF NITROGEN | 59 | ppm | | ppm | | ppm |
| OXIGEN | 5 | % | | % | | % |
| CARBON DIOXIDE | 9 | % | | % | | % |
| GAS PRESSURE | 28.8 | mbar | | mbar | | mbar |
| OPARATION GAS PRES | 20.7 | mbar | | mbar | | mbar |
| WATER TEMP. | 70 | °C | | °C | | °C |
| CALCULATIONS | | | | | | |
| EFFICIENT | 92.4 | % | | % | | % |
| GAS LOSSES | 7.6 | % | | % | | % |
| GAS SUPPLY | 28 | m3/h | | m3/h | | m3/h |
| **HEATING CAPACITY / S.M.** | **147.46** | **WATTS/s.m** | | | | |

**COOLING SYSTEM**

| ROOM | TYPE | |
|---|---|---|
| OFFICES | SPLIT UNIT | FLUSH MOUNTED SEILING FANS |
| CLASS | NA | FLUSH MOUNTED SEILING FANS |
| GYM | NA | |
| BOOKSTORE | SPLIT UNIT | |
| MULTIPURPOSE HALL | SPLIT UNIT | |

**FRESH AIR SYSTEM - VENTILATORS**

| **ROOM** | **TYPE** | |
|---|---|---|
| OFFICES | FRESH AIR FROM WINDOWS | MECHANICAL VENTILATION DOES NOT OPERATE |
| CLASS | FRESH AIR FROM WINDOWS | MECHANICAL VENTILATION DOES NOT OPERATE |
| GYM | FRESH AIR FROM WINDOWS | MECHANICAL VENTILATION DOES NOT OPERATE |
| BOOKSTORE | FRESH AIR FROM WINDOWS | MECHANICAL VENTILATION DOES NOT OPERATE |
| MULTIUSE ROOM | FRESH AIR FROM WINDOWS | MECHANICAL VENTILATION DOES NOT OPERATE |

**LIGHITING**

| **ROOM** | **TYPE** |
|---|---|
| OFFICES | TYPICAL FLUORESCENT LIGHTING |
| CLASS | TYPICAL FLUORESCENT LIGHTING |
| GYM | TYPICAL FLUORESCENT LIGHTING |
| BOOKSTORE | TYPICAL FLUORESCENT LIGHTING |
| MULTIUSE ROOM | TYPICAL FLUORESCENT LIGHTING |

DESCRITPTION OF EQUIPMENT AND OPERATION

HEATING SYSTEM DESCRIPTION

**1 - HEATING PIPE**

Heating pipes are made from black iron in several diameters. The internal part of pipe network are uninsulated. In some cases the radiators are connected vise versa.

**2 - PUMPS**

Pumps are constant speed driven and the opperation is controlled by water temperature in supply line of boiler. In case of damage need to be changed from inverter driven pumps based on EUP 2015 directive.

**3 - CHIMNEY**

Chimney of boiler is uninsulated and does not cover the national regulation for construction material and external insullation.

**4 - BOILER - BURNER**

Boiler operation temperature is constant all over the heating period. Main Operation temperatures are 65-70 °C. There is an already installed temperature controller but it was never been operate

The control strategy of heating system is: Manual On - Off based on daily schedule. Typical operation hours from 7.30 pm to 11.00 pm.

**5- CLASS OPERATION CONDITIONS**

Extremly different temperature per class and per floor. Special problem exist in uper floor of building

**PROPOSALS FOR UPGRATE**

1) Maintenance and repair of waterproof roofing system (water insulation)
2) Reinstallation of temperature control unit for heating system based on external conditions for better oparation end energy consumption reduce
3) Maintenance and regulation of mechanical ventillation per classroom
4) Special study for heating network pipe distribution and recalculate radiators heat capacity